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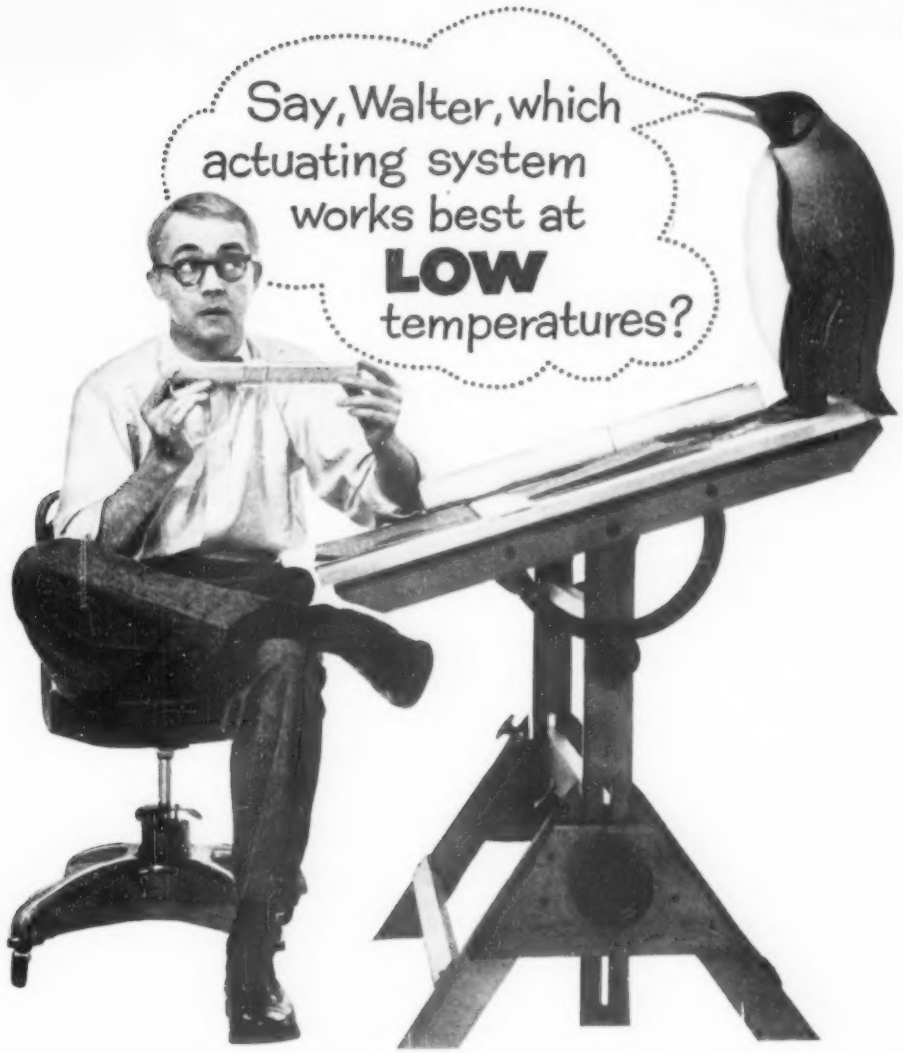

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NOVEMBER 22, 1954 VOL. 61, NO. 21

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Table of Contents on Page 8

53,847 copies of this issue printed

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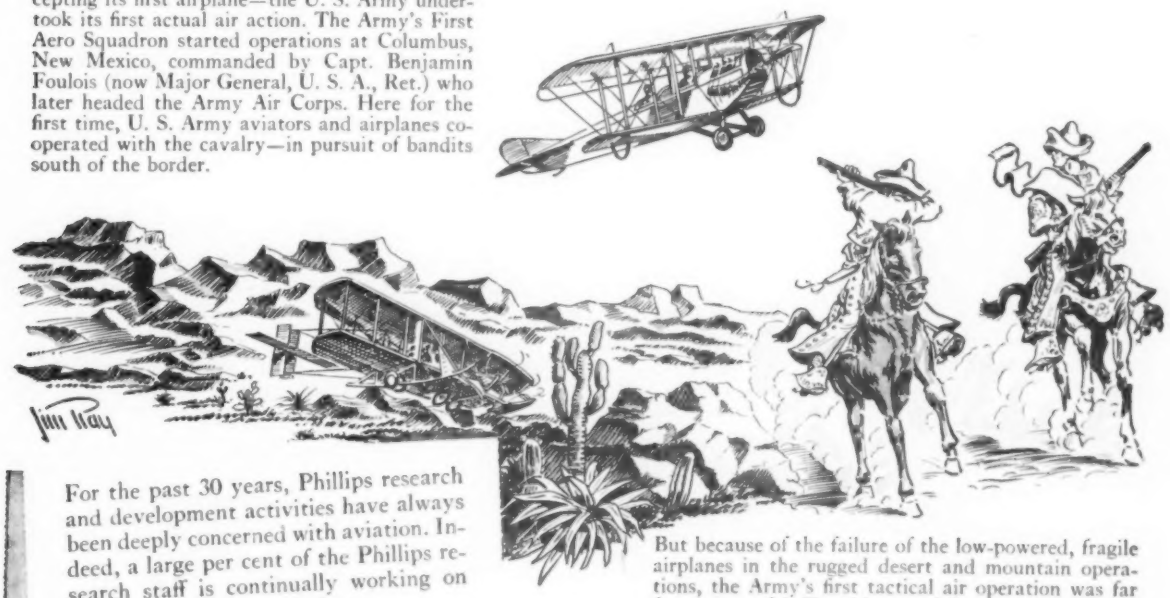
Phillips 66
PRESENTS

MILESTONES IN AVIATION

How a Failure Brought Success to U. S. Army Aviation

In March of 1916—almost seven years after accepting its first airplane—the U. S. Army undertook its first actual air action. The Army's First Aero Squadron started operations at Columbus, New Mexico, commanded by Capt. Benjamin Foulois (now Major General, U. S. A., Ret.) who later headed the Army Air Corps. Here for the first time, U. S. Army aviators and airplanes cooperated with the cavalry—in pursuit of bandits south of the border.



But because of the failure of the low-powered, fragile airplanes in the rugged desert and mountain operations, the Army's first tactical air operation was far from successful. Yet this very failure brought success to U. S. Army aviation, since Congress voted funds for better planes and for the expansion and support of stronger Army aviation.

For the past 30 years, Phillips research and development activities have always been deeply concerned with aviation. Indeed, a large per cent of the Phillips research staff is continually working on problems related to aviation.

From Phillips laboratories have come many of the important chemical discoveries that have made possible the production of high octane gasoline on a truly colossal scale. Phillips now produces tremendous quantities of 115/145 grade aviation gasoline for military and commercial use. Phillips also supplies improved fuels for the latest designs in turbo-props and jets.

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AVIATION PRODUCTS

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ON TIME

The B-47 Jet Bomber is built to GO and go it does with a speed that challenges the imagination (London, England to Limestone, Maine in 4 hours and 43 minutes) even in this day of supersonic speeds by smaller planes. But when it's time to come down, landing and stopping this 6-jet aircraft must be done with both accuracy and dependability. To accomplish this, Boeing Airplane Company uses Pioneer specially-built deceleration 'chutes to approach the runway and larger ribbon 'chutes to shorten the landing roll — a maneuver that has won the praise of the aviation industry — of which Pioneer is proud to be an integral part.

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NEWS DIGEST

Domestic

Third F2Y-1 Sea Dart is scheduled to begin flight tests at Convair's San Diego plant within two months, restarting trials that were broken off when the second supersonic water-based fighter crashed Nov. 4 (AVIATION WEEK Nov. 15, p. 20). Convair says extra work crews are speeding completion of the third Sea Dart.

Convair Terrier, Navy's surface-to-air guided missile with an estimated speed of Mach 2, has been used successfully by the converted battleship USS Mississippi in the air defense phase of the Atlantic Fleet's largest postwar exercise.

Vertical takeoffs could be made by Douglas Aircraft Co.'s 70,000-lb. A3D Skywarrior with 12 Rato bottles to supplement its twin Pratt & Whitney Aircraft J57 turbojets, says Harry A. Nichols, A3D project engineer at the El Segundo (Calif.) Division.

Bailout altitude record of 45,200 ft. has been set by USAF Capt. Edward G. Sperry and 1st Lt. Henry P. Nielsen during tests in a stripped-down Boeing B-47 of the new downward ejection seat. Previous record: 42,000 ft. set in 1950.

Brig. Gen. Charles A. Lindbergh returned to temporary active duty with USAF last week for the first time since he resigned his commission in 1941. He will serve three weeks in the office of Trevor Gardner, special assistant for research and development to the USAF Secretary.

Engineering & Research Corp., Riverdale, Md., aircraft equipment and electronics builder, has been acquired by ACF Industries, Inc.

Budget Bureau has completed a three-month study of Air Coordinating Committee, finds ACC is a useful and necessary federal agency.

Bendix Aviation Corp.'s Pacific Division confirms that it hopes to get helicopter operators to use the Decca navigation aid and ground transmitting equipment (AVIATION WEEK Nov. 15, p. 17). The division has obtained U. S. manufacturing and sales rights to the British-developed system, will begin redesigning to U. S. specifications immediately with pilot units ready for evaluation in approximately 90 days.

C-130 Hercules is the new official name of Lockheed Aircraft Corp.'s turboprop military assault transport.

Russian Light Copter Lands on Truck

Small Kamov liaison helicopter demonstrates its ability to pick its landing spots by setting down on the back of a small truck at Tushino Airport near Moscow following a demonstration flight. The craft has dual three-blade coaxial main rotors.

Maj. Gen. Gordon A. Blake has been appointed USAF member on the executive committee of Radio Technical Commission for Aeronautics. "His appointment reflects the determination of the Air Force to achieve further development and implementation of a common system," says RTCA.

Financial

General Dynamics Corp., New York, reports a consolidated net income of $12,844,834 for the first nine months of 1954, an increase of 37% over $9,377,061 for the same period last year. Net sales totaled $431,017,298, compared with $430,789,199. Backlog Sept. 30: approximately $923 million plus an estimated $410 million in contracts under negotiation.

Curtiss-Wright Corp., Wood-Ridge, N. J., had a consolidated net profit of $11,454,782 for the first nine months of 1954, increasing from $8,058,376 for the first three quarters of 1953. Sales climbed to $348,261,589 from $317,885,461. Backlog Sept. 30: approximately $736 million, dropping from $783 million at mid-year.

Western Air Lines' net income for the first nine months of 1954 totaled $1,037,134, compared with $1,048,763 for the same period of 1953. WAL paid a regular quarterly dividend of 15 cents Nov. 15 to Nov. 1 stockholders.

Emery Air Freight Corp. has declared a semi-annual dividend of 10 cents per share, payable Dec. 15 to stockholders of record Dec. 1.

International

Sncaso Vautour averaged 734 mph., during a recent 3,675-mi. flight. The French fighter, powered by two Sneema Atar 101Ds, streaked over Istres Airfield in France 30 min. after it took off from Villaroche.

East German Lufthansa has postponed its first flight to December, reliable sources in Vienna report. The Communist airline originally planned to start operating its 16 Russian transports on routes behind the Iron Curtain this month (AVIATION WEEK Oct. 18, p. 114).

De Havilland Venoms have been restricted by Britain's Air Ministry on certain types of aerobatics and use of wingtip tanks, press reports from London disclose.

Saab 32 Lansen will be produced as a two-place trainer, the fourth version for Sweden's 700-mph.-plus multi-purpose jet aircraft.

Hiller UH-12B helicopter has been purchased by Philippine Air Lines, the fifth of this type ordered by PAL in 1954.

French government has opened a credit of $1,812,000 for aircraft equipment and $1.2 million for aviation gas imports from the dollar area.

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The Aviation Week

November 22, 1954

Headline News

TAC Shapes Atomic Strike Force..... 14
FSF Honors Trio for Safety Work..... 15
What Is Britain's ARB?..... 15
ARB, Designers Change Rules..... 15
New Lockheed Orders $158 Million.... 16
Feeder Policy 16
CAA Tightens Control on Exports..... 17
AIA Asks $500 Million for New Tools.. 18
ARB Chief Scores British Copter Lag.. 19
Caravelles Need $7.8 Million..... 20
Picket Planes: All-Around Threat..... 23
Heli-Float Passes Landing Tests..... 30
Small Business Is Key to Air Lead.... 32
AMC, ARDC Officers Promoted..... 36

Aeronautical Engineering

How Northrop Sets Up Engineer Staff.. 39
Details of XT-37 Twin-Jet Trainer.... 46
NACA Shows Lift-Fuselage Model..... 49

Avionics

Diode-Amplifier Is Threat to Tubes.... 53
Avionics Companies Report Changes.. 58

Equipment

Bendix GCA Set Stresses Versatility... 59
Boeing Tells Why 707 Gear Failed..... 68

Financial

Plane Sales Bolster Delta Report.... 74

Air Transport

Airlines in Fare-Cost Squeeze..... 88
FTL Proposes 'Steerage' Air Travel.... 91
ACC Tightens Airport Policy Control.. 91
Air-Rail Mail Fight Splits CAB..... 92
Costa Rica Field to Take Big Liners.. 93
LAA Starts Passenger Copters..... 93
RTCA's VHF Trigger for Field Lights.. 93

Editorials

Tackle the Collision Measure..... 98
Over the Arctic to Europe..... 98
A Piper Flight to Paris..... 98
No Deaths—No Headlines..... 98

Departments

News Digest 7
Picture Page 9
Industry Observer 10
Who's Where 10
Washington Roundup 13
Thrust & Drag..... 49
Production Briefing 52
Filter Center 58
What's New 71
Overseas Spotlight 81
CAB Orders 94
Shortlines 94
Cockpit Viewpoint 96
Aviation Calendar 96

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9—(top) USAF; (center left) Bell Aircraft; (center right) Chance Vought; (bottom) North American Aviation; 17—Fairchild Aircraft; 20—Ford Motor Co.; 39-40—Northrop Aircraft; 49—NACA; 52—McGraw-Hill World News; 53—(top) Hughes Aircraft; 59, 61—Bendix Radio; 91—NWA; 94—BEA.

THIRSTY REPUBLIC F-84G slips under Flying Boom refueling nozzle maneuvered by the operator under Boeing KC-97 tanker.

Jet-Rocket Planes Make Up U.S. Team

SUPERSONIC TWINS are USAF Bell X-1A, foreground, and X-1B, identical except for instrumentation. Rocket-powered planes are at Edwards AFB, Calif. X-1A attained 1,650-mph. speed, 90,000-ft altitude.

BEVY OF CUTLASSES, with underbelly rocket pods, await delivery at Chance Vought's Dallas plant to Navy squadrons on both coasts. The F7U-3's two Westinghouse J46-WE-2 turbojets have afterburners. Stencil on lower portion of F7U-3's tail reads: Experimental finish. Do not paint.

LONG FLAME shoots from afterburner of P&WA J57 engine in supersonic North American F-100A Super Sabre during night trials.

INDUSTRY OBSERVER

► Boeing XB-47D, powered by a combination of turboprop and turbojet engines (AVIATION WEEK Apr. 19, p. 14), now is scheduled for flight about Dec. 15. Aircraft will have Wright T49 substituted for each inboard pod normally housing two General Electric J47s. A J47 remains in each outboard pod.

► **Air France Constellation recently made a completely automatic approach to operate on two fules, Grade 83/91 Automotive and Grade 100/130 Pioneer P-B 10 autopilot with automatic approach coupler. Pilot took over only after the main wheels touched the runway.**

► Boeing B-52 reportedly handles better than the B-47 in refueling from a KC-97 tanker because of better low-speed characteristics.

► **Army selection of helicopter powerplants will be hinged to their ability to operate on two fuels, Grade 83/91 Automotive and Grade 100/130 Aviation. Army plans to use only these two fuels in future copter operations to simplify the logistics problem.**

► Glenn L. Martin Co.'s B-57C will have thicker-skinned control surface than the original model of the American-copied Canberra light bomber. Early tests of the B-57A by Tactical Air Command revealed the thin-skin weakness of the British design.

► **Transition of pilots from the B-47 to the B-52 requires only about 15 hr.**

► Problem of dust is causing increasing concern to the Army in its helicopter operations. In a recent test under simulated dust and dirt conditions, an engine failed after only 25 hr. of operation in a helicopter. Lack of improved induction air filtration is costing the Army about $5,000 daily.

► **Boeing and USAF reportedly are looking for a new source of B-52 defensive fire control systems. Present equipments are under development by Arma and General Electric. Avco's Crosley Division and General Mills are mentioned as possible new suppliers.**

► Russia is lagging "far behind" the U. S. in transistor developments, one of two Russian engineers visiting the recent Baltimore avionics conference told an exhibitor. Both showed considerable interest in a General Electric model of a radar-equipped air-defense picket plane and in Westinghouse mockups of bomber and interceptor fire controls.

► **Bell Aircraft's Helicopter Division is trying to interest the Navy in a utility version of its Model 47J, tentatively designated the HUL. Copter will carry four persons, or two litters, an attendant and pilot. It has demonstrated its ability as a rescue ship using a Navy hoist. Bell plans to use 47J as the new designation for the 47G-1 (Aviation Week Nov. 8, p. 15).**

► Piper Aircraft has sold its Apache twin-engine aircraft production for next six months. Now producing slightly more than one a day, firm may institute program to nearly double output. Airline in Bogota, Colombia, has ordered six Apaches for passenger service.

► **Helicopter accident rate in USAF is nearly three times the rate for all aircraft. Improvements are needed in landing gears, control and pilot understanding of blade stall, crash study report show.**

► Sound engineers believe that an axial-flow jet engine, developed along by-pass principles, could be the most quiet of rotor-tip propulsion devices for copters.

► **Rick Helicopters, major commercial operator, keeps 11 log books for each aircraft. They record history of airframe, engine, transmission, engine mount, swash plate, mast, stabilizer, hub, main rotor blades, tail rotor blades and tail rotor gear box.**

WHO'S WHERE

In the Front Office

Dr. T. P. Wright, former Civil Aeronautics Administrator (1944-45) and now vice president-research at Cornell, Ithaca, N. Y., has become professor of air transportation at the university's School of Business and Public Administration.

George T. Cussen has been appointed vice president in charge of freight operations for Flying Tiger Line.

R. W. Richardson is new vice president-sales for Goodyear Aircraft Corp., Akron, Ohio. Other changes: **Oscar W. Loudenslager**, research coordinator; **Ralph L. Ravenscraft**, manager of the research and development department.

Leonard D. Sullivan has moved up to vice president-sales of Babb Co., Newark, N. J.

J. A. Limoges has become a director of Bristol Aeroplane Company of Canada, will be succeeded as secretary of the Montreal firm and Bristol Aero Engines, Ltd., by **B. A. Chalmers.**

Louis Achitoff has joined Flight Safety, Inc., Flushing, N. Y., as assistant to the president.

Changes

Dr. Lewis C. Sorrell has resigned effective Dec. 15 as director of Air Transport Assn.'s Economic Research Division to accept the Walker-Ames Service Professorship in Transportation at the University of Washington, Seattle.

Randall H. Carpenter is new manager of Flight Safety Foundation's Air Transport Division, New York.

Lt. Gen. Doyle O. Hickey (USA Ret.) has been appointed director of Continental Motors Corp.'s New Products Division, Detroit. Division manager: **H. J. Buttner.**

Thomas J. Kirkup has become general traffic and sales manager for Mohawk Airlines.

James R. Kerr is director of Avco Manufacturing Corp.'s new West Coast Division, Los Angeles.

Kermit F. Wasmuth has been named quality control director for Republic Aviation Corp., Farmingdale, N. Y.

Dr. Bennett S. Ellefson has been promoted by Sylvania Electric Products, Inc., New York, to technical director.

Joel R. Baker has moved up to chief engineering test pilot for North American Aviation, Inc., Los Angeles, succeeding the late George Welch.

Honors and Elections

Warren H. Brand, engineering and research director for Conoflow Corp., is new president of the Instrument Society of America.

John D. Ryder, dean of the School of Engineering at Michigan State College, has been elected president for 1955 of the Institute of Radio Engineers.

Carl W. Lemmerman, president of Industrial Sound Control, Inc., has become president of the National Noise Abatement Council.

"Fleet Fighters"

Potent Chance Vought F7U-3 Cutlasses stand poised on the flight line, ready for delivery to fighter squadrons of the U. S. Fleet. Outstanding examples of Naval Aviation's new hard-hitting strength, these swift, powerful aircraft are designed to serve as interceptors, fighters or attack planes.

Chance Vought Aircraft INCORPORATED

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Quoted from talk by Einar Pedersen, Chief Navigator, Scandinavian Airlines System, before S.A.E. meeting at Atlantic City on June 11, 1953.

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Washington Roundup

USAF Combat Revolt?

USAF shortly will have to cope with a revolt by its combat commanders against the alarming growth of bookkeeping activities. Many air bases have as many comptrollers as pilots; some report more "bookkeepers" than fighting men.

No one challenges the need for good management in the ultra-expensive Air Force business. Complaint is that the system has developed too much minutiae at the wing and base level.

Supervisory personnel are so bogged down with costing, budgeting, accounting and officers' club profit and loss statements that they now feel the price can be measured in losses of $300,000 airplanes. These planes might have been saved, if the commander had been free to use his hard-gained experience supervising the flying and the training of his command.

More important, it may be penalizing the commands with loss of combat readiness. One top combat leader says: "If present trends continue, we will know exactly how we spend every penny, but we will have lost our combat capability in the process."

Community Airline

Local backing, which Civil Aeronautics Board members have been urging for local service airlines, will be reflected in the reorganization of Lake Central Airlines. Management and control will be with employes and representatives of local business and financial interests. Reorganization arrangements probably will be completed this week.

Offensive Seaplanes

Naval Aviation backers are promoting an offensive role for the seaplane in nuclear warfare. James H. Smith, Jr., Assistant Navy Secretary for Air, told an American Legion post in New York that "two or three seaplane squadrons in an area thousands of miles from American soil could maintain a threat to an entire flank and require a diversion on enemy defenses from other fronts without exposing vulnerable fixed bases to an enemy's counterattack. . . .

"The seaplane can soon be given the speed and altitude and load-carrying capabilities of land-based jet bombers. It can be given the ability to operate from any sheltered bay, gulf, lagoon and estuary having sufficient water depth. It can be given the capability to land in semi-sheltered sea areas, refuel from a waiting submarine and proceed on its mission.

"With these capabilities it could deliver powerful weapons to vital targets. . . . With perhaps half a dozen seaplanes, a single tender, and a pair of tanker submarines, we could provide an integrated force that an enemy could not ignore. Once nuclear propulsion can be fitted to the seaplanes—and for this they appear ideally adapted—the submarines could be dispensed with and the tender base moved still farther back out of attack range."

Smith reiterated Navy's argument against land bases. He said an increase in the range of enemy weapons would make "our immovable home bases vulnerable to sudden overwhelming attacks which could prevent our counterattack." And, says Smith, the overwhelming counterattack is the primary basis of nuclear warfare defense.

The counterattack potential must be dispersed on aircraft carriers—"moving bases," he believes. He also visualizes a carrier striking force composed of three large carriers, seven cruisers and two highspeed supply ships.

$3 Billion for Transports?

Airlines may have to spend up to $3 billion on new planes and equipment over the next ten years, Air Transport Assn.'s president Earl Johnson believes. It will be for: "substantial replacement" of reciprocating engine fleets with turboprops; "specially designed" cargo fleets; "limited" replacements with helicopters; addition of a "substantial" fleet of jet aircraft; new ground, flight line and airways equipment.

Civil Aeronautics Board member Oswald Ryan recently estimated the cost to airlines in converting from piston to turbine-powered transports over the next 10 years at $1 billion (Aviation Week Nov. 1, p. 83). Both Ryan and Johnson proposed bigger profit margins to enable the financing—without resort to government subsidy.

NATO Fighter Decision Near

Decision on lightweight fighter planes of European design that will be bought for NATO will be made soon by office of Donald A. Quarles, Assistant Secretary of Defense for Research and Development. USAF is providing technical guidance in selection of a design, which must be a low-level fighter-bomber to support ground forces. For this reason, among others, Folland Gnat may not be acceptable.

For a starter, Quarles and his USAF advisors have a report of a board headed by Dr. Theodore Von Karman which presumably has listed possibilities. A final selection is expected at least by early December.

The plane or planes that are built will come under the Mutual Weapons Development Program, formerly called the Mutual Special Weapons Program, a title dropped because it carried the implication that atomic or nuclear weapons were involved. Aim of the program is to assist the technological capabilities of NATO countries, providing technical and financial assistance.

Wilson 'Encouraged'

Look for Defense Secretary Charles E. Wilson to pay an increasing number of visits to aircraft plants. Back from his recent visit to the West Coast, he told reporters he felt "greatly encouraged" by the brief tour, adding that he is "determined to make a lot more trips like this to see what the industry is doing."

Asked whether U. S. is working on the satellite space ship program mentioned by Secretary Forrestal in 1948, Wilson said he was not aware of such a project. When a newsman told him there are reports that the Russians are pushing such a vehicle and may beat our scientists in the race for outer space, Wilson said, "I wouldn't care if they did—that is, flew off to the moon or some other place." He added that he knows of enough problems on earth without looking for some outside.

More seriously, the Secretary predicted that the fiscal 1956 defense budget will be more than $29 billion. He said the Defense Department has been spending money faster than it is appropriated, making substantial cuts in the unexpended balance on hand and letting some other funds lapse. By this process, he said, about $17 billion has been cut from the unexpended balance in the past three years.

—Washington staff

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TAC Shapes Mobile Atomic Strike Force

- **F-84Fs, B-57Cs and C-130s make up self-contained tactical units ready to move swiftly into trouble areas.**
- **New combat organizations could stop aggression and upset Red intelligence as cold war maneuver.**

A radically new, highly mobile combat organization is taking shape in the Tactical Air Command—an aerial strike force composed of three different types of aircraft and designed to wage tactical atomic warfare in any theater of operations.

If tests next year prove the soundness of the new units planned by TAC's Ninth Air Force, USAF would abolish its traditional tactical squadrons of three identical 25-plane groups.

The new units, as now conceived, would consist of approximately 16 Republic F-84Fs, eight or 12 Martin B-57Cs and a number of transport-tankers, probably the turboprop Lockheed C-130.

▶ **Self Contained**—Each unit would be a self-contained fighting or strike force, ready to pick up and move from a stateside home base to any trouble spot in the world in a matter of hours.

Fighter-bombers and light bombers carrying atomic weapons would provide its bombing capability. These same aircraft would provide the reconnaissance needs of the strike force. Adequate cameras can be installed in place of armament on both the Thunderstreak and the B-57.

The C-130 or another transport would provide both transportability to the essential combat elements of the unit, including an initial 30-day supply of spares, and range extension for the combat aircraft.

This tanker function with the C-130, for example, would be possible by using six 400-gal. fuel cells mounted on pallets for easy installation and removal in the cargo compartment. A seventh cell would be a probe-and-drogue refueling unit.

▶ **Buddy System**—Included in Ninth's conception of the strike force is an in-flight refueling installation for both the F-84Fs and the B-57Cs.

Using the buddy system, it would be possible for a fighter-bomber team to make a deep, 1,000-mi.-plus penetration to enemy targets carrying atomic weapons. Four fighter-bombers—one carrying the atomic package, one acting as the bomber's wing or coverman and possibly carrying a precision high-altitude bombing sight, plus two serving as tankers with refueling cells slung externally—would be refueled by the C-130 tanker at altitude a safe distance short of enemy territory. Tight formation flying at high altitude would make it possible to use a simple, short drogue for refueling.

The strike flight would continue until the refueling fighters could top off the tanks of the fighter-bombers. Following the strike, refueling fighters would pick up the bombing fighters on the way home.

▶ **Launching Sites**—One further requirement of the strike force is a series of advance air bases in readiness wherever action may be necessary in supporting America or its allies against aggression.

Commitments include adequate runways, fuel facilities, cooks and bakers and possibly air defense. It is probable that these could be provided by the ally who grants the base rights.

For example, only the equipment and supervisory cook and baker personnel need come from USAF.

▶ **Cold War Weapon**—As described to AVIATION WEEK, the new tactical organizations should provide a necessary maneuver factor in the cold war as well as a hard-hitting attack force.

These mobile atomic-capable striking forces could appear suddenly anywhere in the world on maneuvers with our allies.

A unit one month might be operating in northern Japan with the Japanese safety forces. The next month another or the same unit might be running through exercises in the Philippines or Thailand. Communist intelligence would be upset continually by such operations.

▶ **Back Stiffener**—These strike forces, moreover, would enable the U.S. to show the flag properly and effectively around the world. Navy fleet activities no longer are effective in this field. Neither is the visit for a few days of a flight of F-84Gs or F-86 Sabres to Thailand.

But a really effective and back-stiffening demonstration would be the joint maneuvers of a tactical strike force with Thailand's military forces, for example.

Allies then might understand that a Sunday punch was available to help them in case of aggression.

▶ **Composite**—Most of the equipment needed by TAC now is available, although assigned in the normal and traditional units.

By next spring TAC and Ninth expect to run some tests with composite units at Wendover AFB, Utah. The strike force would move from its home base on a 4,000-mi. nonstop flight to Wendover; it would be expected to complete the move in 12 hr. and be in action within 2 hr. after arrival at Wendover.

As thought out by Ninth, there is a requirement that a tactical striking force be capable of moving overseas in 12 hr., ready to fight, and self-equipped (except for fuel and possibly weapons) to stay in action for 30 days. The movement capability is plotted out in 4,000-mi. segments.

Longer movements would take proportionately longer, but tactical units would be expected to move from Shaw AFB, S.C., to bases in the Far East within 36 hr.

▶ **Little War Capability**—Development of the new idea is the result of two years' study by combat-experienced TAC officers of both the capabilities of new weapons and new aircraft and the probable kind of war American forces will fight in the future.

Atomic weapons concentrated in single packages have more destructive

Routine Grounding

Grounding of North American F-100 Super Sabres following three crashes is entirely routine, USAF reports. The fighters will be kept out of service pending a hunt for "bugs."

Meanwhile, F-86 Sabres still are grounded at Nellis AFB, Nev., following four accidents in six months (Aviation Week Nov. 15, p. 7). More than 200 of the aircraft at the base are being inspected for technical order compliance.

power than thousands of bombs. A single fighter-bomber or light bomber on a single mission, therefore, can do more damage to the enemy than hundreds of aircraft flying hundreds of sorties with old-style armament.

Modern jet aircraft are capable of delivering strikes against the best defended targets today. They have speed and maneuverability plus all-weather, round-the-clock operating capabilities.

On the other hand, the rising balance of strategic capabilities between the U. S. and Russia may eliminate the possibility of a hydrogen war. So the U.S. needs to be prepared to handle little wars.

TAC's new look aims at providing a modern air striking force to handle little wars with modern weapons.

FSF Honors Trio For Safety Work

"Outstanding contributions" to aviation safety through human deceleration studies, fire protection research and anti-collision light development are recognized in three awards presented by Flight Safety Foundation on behalf of AVIATION WEEK.

The 1955 FSF annual safety award winners:

• **Lt. Col. John P. Stapp,** USAF Aeromedical Field Laboratory, "for originality and ingenuity used in the systematic investigation of the effects of rapid deceleration on the human body, establishing design parameters which provide an optimum of protection for aircraft occupants under loads suddenly applied to the body or during high altitude evacuation; and for great personal courage in conducting his experiments."

Stapp volunteered for a series of deceleration studies that involved shooting at high speeds along a track in a rocket-powered sled and stopping suddenly to produce high G forces.

• **Technical Development and Evaluation Center,** Civil Aeronautics Administration, for "its investigation and evaluation of devices designed to detect fires in flight and for fire protection, and especially to Harvey Hansberry for his leadership in the field."

• **United Air Lines** for the part it has played in the development and testing of anti-collision lights as an interim measure to reduce the mid-air collision hazard.

The presentations were made Nov. 11 by FSF managing director Jerome Lederer during the foundation's annual three-day air safety seminar, held at Bishop's Lodge, Santa Fe, N. M.

Plaques are presented by FSF following consultation with air safety specialists and approval of the Industry Advisory Committee of the organization.

What Is Britain's ARB?

Britain's Air Registration Board is a regulatory group concerned chiefly with issuing certificates of airworthiness to civil aircraft.

The board consists of 18 members: four representing operators, four from manufacturing, four from insurance, four independent members, a commercial pilot and a representative of the general public.

Total staff of the executive is 250, divided about evenly between administrative and technical personnel. Of the approximately 125 technicians, about two-thirds are concerned with licensing and inspection and about one-third with investigation of design.

Composition and affiliations of the board members:

- Lord Brabazon of Tara, chairman.
- Sir M. E. Denny, president of William Denny & Bros., Ltd. (shipyards).
- Sir Frederick Handley Page, chairman and managing director, Handley Page, Ltd.
- Guy F. Johnson, aviation insurance.
- A. B. Stewart, affiliation not known.
- Capt. M. J. R. Alderson, manager and senior pilot of British Overseas Airways Corp.'s Comet fleet.
- A. G. Elliott, joint managing director and chief engineer, Rolls-Royce, Ltd.
- Lord Douglas of Kirtleside, chairman, British European Airways Corp.
- E. R. H. Hill, aviation underwriter.
- Capt. A. G. Lamplugh, underwriter and principal surveyor of British Aviation Insurance Co., Ltd.
- L. Murray Stewart, affiliation not known.
- John D. North, chairman and managing director, Boulton Paul Aircraft, Ltd.
- Col. R. L. Preston, secretary-general, Royal Aero Club.
- J. Eric Rylands, managing director, Lancashire Aircraft Corp.
- F. E. N. St. Barbe, sales director, de Havilland Aircraft Co., Ltd.
- Whitney Straight, deputy chairman BOAC.
- J. J. Taylor, secretary and general manager, Workers Travel Assn., Ltd.
- Maj. R. H. Thornton, member of BOAC board.

Comet Hearing Developments

ARB, Designers Revising Rules

By Seabrook Hull
(McGraw-Hill World News)

London—Probably no one will be blamed for the crashes of British Overseas Airways Corp.'s Comet 1s at Elba and Naples earlier this year.

But Britain's Air Registration Board is changing its pre-acceptance requirements for airworthiness certificates because of the continuing efforts to determine the cause of the two crashes.

And, in turn, British airframe builders now will design and manufacture under a new set of rules.

▶ **Crash Verdict**—As the court of inquiry last week began its final session following the appearance of witnesses from Comet builder de Havilland Aircraft Co., it appeared almost certain the verdict would find metal fatigue in the pressurized cabin caused the Elba crash —and perhaps the one at Naples (AVIATION WEEK Nov. 15, p. 15).

Although opinions to the contrary have been voiced in the court by highly respected, technically qualified witnesses, no substantial evidence to the contrary has been offered.

Unresolved is the coincidence that both crashes took place after a normal takeoff and near the top of a normal climb from Rome airport.

Also unanswered is whether some of the peculiar properties of Redux under high temperatures—as when an aircraft is on the ground for long periods under a tropic sun—or the differing rates of expansion between Reduxed members during temperature changes in climb and descent contributed to the excessively high stresses that brought on the early fatigue failures both at Elba and Naples and in the tank tests at Farnborough.

▶ **Basic Changes**—Although it conceivably could turn out at some later date that the Royal Aircraft Establishment did not come up with the actual cause of these two crashes, it already is obvious that a considerable amount of knowledge has been accumulated to the benefit of aviation the world over.

As a result of what has been learned, ARB has outlined to the court the basic changes it plans in its requirements:

• **First,** ARB suggests it will require two complete airframes without equipment for tests, one for water-tank fatigue trials and another for static tests.

The water-tank tests must include simultaneous flight-gust and pressurization loadings, probably to 15,000 pressurization reversals, with equivalent 1G flight and 10 ft./sec. gust loads.

Two airframes are required because:

(a) it was determined at Farnborough that preloading in the form of excessive static loads voids the value of the structure for fatigue testing, and (b) a fuselage that has been excessively tested for fatigue does not present a valid specimen for static testing.

In addition, components probably equivalent to another complete airframe will have to be supplied for testing "to destruction" in order to determine their average fatigue life—thus, by dividing by three, their minimum safe life.

• **Second,** flight tests will include extensive flying over proposed routes with a fully instrumented aircraft.

• **Third,** ARB will add one or more members, picked for "their eminence in the scientific field."

• **Fourth,** an expanded research program will investigate the whole problem of fatigue in high-grade light alloy metals. This latter, although not precisely a new pre-acceptance requirement, is expected to result in new conditions of test for parts and components as well as new design rules.

ARB does not expect water-tank fatigue testing to destruction will be a requirement for the indefinite future. Apparently what is in mind is the need for empirical proving of airframes until such time as the results of a long series of physical tests can be assimilated into a coherent and reliable set of rules relating fatigue life to structure design. When this is done, ARB indicates, pre-acceptance testing may be modified.

▶ **Missed Point**—The de Havilland witnesses appeared briefly. No attempt was made to prove DH was right in everything it did. In fact, it virtually was admitted that, in the light of what is known today, both the company's calculations of stress and empirical tests of the static and fatigue strength of the aircraft were invalid.

Chief designer R. E. Bishop said: "We obviously missed the point."

About the only court tactic employed by de Havilland was to show that it had used properly all the information available at the time of the Comet's development, had subjected the Comet to tests far in excess of any requirements in ARB's, International Civil Aviation Organization's or Civil Aeronautics Administration's rules and recommendations, and that even today there was a considerable amount of honest, expert disagreement over the relative value of empirical tests as against mathematical calculations, and importance of strain gage readings and how best to calculate stress.

For example, evidence as presented indicates that DH still preferred its own stress analysis methods to those of Sir Arnold Hall, RAE director.

In this latter context, however, the proving piece of evidence would seem to be the fact that two Comets failed in flight under what appears to be fatigue failure due to excessive stresses in certain areas and that one test transport failed for the same reason in RAE's water tank.

▶ **Comet 2 Delay**—There are reports that de Havilland is starting to modify those Comet 2s that were under construction. Even so, a considerable delay in deliveries of the aircraft necessarily must result. It seems obvious that the new Comet 2 also will have to undergo water-tank tests.

Another point raised is the fact that the Comet 2 recovered with a heavier skin and with its structure beefed up must weigh more than the original model on which all orders were based. Serious doubt remains whether the airlines that ordered Comet 2s now will leave those orders in force.

▶ **Comet Future?**—As to the future of the Comet as a commercial airliner, little more than speculation is possible. The Comet 1 apparently is finished.

Some estimates are that the Comet 2 cannot get into commercial service now for another 18-to-24 months. By then its competition from other jet types and turboprops would be considerable.

There is considerable talk that the government may buy up the remaining Comet 2s (as finally modified) as service transports or that BOAC will be forced to keep its order intact in the hopes of proving the Comet name a safe and reliable one as a sales basis for the Comet 3.

One thing is certain: The government will not let de Havilland get into serious financial trouble as a result of this situation. If necessary, there will be a straight bailout of some kind.

But DH hopes this will not be necessary, that there will not be any wholesale cancelation of Comet 2 orders.

New Lockheed Orders To Total $158 Million

Burbank, Calif.—Lockheed Aircraft Corp. has in final negotiation an additional $158 million in military orders for the California Division.

The orders, to be announced soon, include initial production for "a new airplane not yet publicly announced" and additional purchases of two models now in production.

▶ **$390-Million Boost**—Together with Defense Department orders recently announced (AVIATION WEEK Oct. 18, p. 14), these orders from fiscal 1955 funds will bring additional business for Lockheed to nearly $390 million.

Major orders among those already disclosed include an initial production order for the F-104 day superiority fighter, an additional order for turboprop C-130 transports and one for modification of B-47 jet bombers.

The F-104 will be produced at Lockheed's Burbank plant. First F-104s will be manufactured and assembled entirely at Plant B-1, with later aircraft in the series going through final assembly and flight testing at Palmdale. Lockheed T-33 final assembly also is at Palmdale.

Factory B works manager Dan Gribbon reports the F-104 line will be established in a portion of the area formerly occupied by the F-94 line.

▶ **Production Schedule**—Gribbon, in a review of current and forthcoming B-1 projects in the Lockheed Star, also reveals:

• Orders for the C-130A will carry production on the turboprop transport through 1956, with the Burbank plant handling fabrication and assembly of fuel tanks, center section and outer wing flaps, ailerons and the upper aft cargo door. C-130 manufacture is at Lockheed's Marietta, Ga., plant.

• Orders on hand for production of P2V nose sections and tip tanks will continue this work to mid-1956.

• Fabrication and assembly of jet pods for the P2V-7 (AVIATION WEEK Nov. 1, p. 24) and for P2V-5s and P2V-6s, being modified by Lockheed Aircraft Service, will extend until late 1956.

• RT-33s and T-33 trainers are on order for delivery into the first quarter of 1956.

Feeder Policy

- **Murray proposes plan to help local service.**
- **Permanent certificates proposed for 'few' lines.**

Commerce Undersecretary for Transportation Robert Murray put the Administration squarely behind active development of local service airlines in a policy speech last week, dispelling apprehension that plans are afoot to turn their routes over to trunk carriers.

He suggested that "a few" local service lines already have merited permanent certification. He proposed long-term subsidy contracts of "several years" duration so that both the government and the local lines might know where they stood and could plan accordingly.

▶ **Reasonable Opportunity**—"At present, neither the government nor the carriers can plan ahead with any real assurance as to the subsidy level from year to year," he commented. "At any time, the filing of a carrier's petition or the issuance of a Civil Aeronautics Board order can immediately throw into uncertainty the amount of subsidy payable."

Murray summarized the recommen-

dations of the Air Coordinating Committee on local service airlines–widely criticized as spelling extinction for the small carriers–like this: "Strengthen these carriers, give them every reasonable opportunity to succeed and then let their success or failure determine their future place in the industry."

However, he emphasized that development of the local lines must be a "two-way street."

▶ **Subsidy Timetable**–Proposing that Civil Aeronautics Board establish timetables for eliminating government subsidy, Murray said: "We have now reached a point where the board should be able to establish such goals. It should let the carriers know, in definite terms, the degree of self-sufficiency which they will be expected to attain by specified dates in the future.

"The carriers should be placed clearly on notice that their success or failure in meeting these goals will be a dominant factor in the future Board actions involving renewal or discontinuance of their temporary authorizations, the granting of permanent certificates and the determination of subsidy allowances."

▶ **Feeder Development**–In addition to longterm subsidy contracts, the program Murray advocated for development of local service carriers in a presentation to the Aviation Distributors and Manufacturers' Assn. included:

• **"Considerable relaxation"** of the route restrictions that now prevent local service carriers from providing flexible, limited-stop service between various points on their routes.

These restrictions, he said, "go much too far in limiting their operational flexibility and their ability to develop the traffic potential of their systems. Some of these restrictions actually prevent nonstop local service between points not receiving direct service by any other carrier."

Qualifying that local service should not duplicate trunk service, he called for "prompt and substantial liberalization of local service operating restrictions."

• **Local service and trunklines** in the same geographical area "should be encouraged to work out voluntary agreements" for their mutual benefit, subject to CAB approval.

"To encourage the trunklines to participate fully and freely in such a program," Murray observed, "it might be stipulated that any increased authority received by a local service line as a result of such voluntary agreement will remain effective only so long as such carrier retains its identity as an independent local service airline.

"This should overcome the understandable trunkline concern that authority now transferred to a local service carrier might, at some future date, end up in the hands of a competing trunkline as the result of a merger or acquisition."

• **Airline service** should be suspended at points that have demonstrated insufficient traffic potential to warrant scheduled flights. To illustrate, Murray said about 80 local service stations generated an average of less than three passengers per day during a recent year.

"There remains a need for developing definite standards as to the minimum level of traffic a community should generate in order to justify continued air service," Murray said. "Communities should then be given a reasonable period within which to meet such minimum standards." If they don't, "expeditious" suspension proceedings should be held, he said.

• **Local service mergers** "can provide significant opportunities for economic improvement," reducing overhead and lessening the subsidy requirement.

• **Local airlines** should make an active effort to cut costs by cooperative arrangements for handling such matters as the purchase of commonly used supplies and the overhaul of equipment.

Army Secretary Flies In Fairchild C-123

Secretary of the Army Robert T. Stevens has his parachute harness adjusted by Richard A. Henson (left in smaller photo), chief test pilot for Fairchild Engine & Airplane Corp., prior to flying in the new C-123B Avitruc at Hagerstown, Md. In photo above, Henson flies the Avitruc low past watching Army officials. He has feathered the left propeller for single-engine flight. Also present at the demonstration: Army Chief of Staff Gen. Matthew B. Ridgway and his staff. The officials also toured the Fairchild plant, inspected C-123 production lines and were briefed on products under development.

CAA Tightens Control On Plane Part Export

Civil Aeronautics Administration has ordered tighter control over the quality of used aircraft parts sold for export, placing greatly increased responsibility on manufacturers and repair stations.

The climax of a long series of complaints from foreign governments and purchasers about unairworthy products, the new rule will relieve CAA safety agents of blame for shoddy shipments. Manufacturers and approved repair stations could lose their certificates if they export defective parts.

George H. Weitz, chief of the general maintenance branch, Office of Aviation Safety, says the new regulation is welcomed by reputable dealers.

▶ **Diplomatic Backfire**–"Some portion of the vast amount of surplus parts always seems to find its way back into use, despite the fact that it was sold for junk," Weitz says.

"The junkie buys it by the ton, then salvages parts that can be scrubbed up or refurbished and put on the market. The result is that CAA gets the backfire, and sometimes it comes through high diplomatic channels."

CAA's safety agents cannot examine and vouch for every item before they issue export certificates, says Weitz. An

agent called into a repair station and shown a number of overhauled engines may make a spot check, but he cannot be positive every part is flawless.

► **Chamber of Horrors**—F. C. Schwager, CAA's international region maintenance advisor, has a "chamber of horrors" that includes a large packing case full of faulty parts taken from "overhauled" engines sold to one French customer.

Schwager and his agents have been called all over the world to inspect shoddy goods bought from U. S. dealers. There are cases, Schwager says, where the blame must be shared by the purchaser, who fails to be represented here by a competent agent.

CAA also says much unairworthy material is shipped without an export certificate of airworthiness. Efforts to make foreign buyers insist on this insurance have not been successful.

► **Billion-Dollar Business**—Reputable firms, pointing out that the sale of used aircraft parts has become an annual multi-billion-dollar business, report new quantities of surplus military material will be available in the near future.

It is estimated that fringe operators, without an established name and future business to protect, account for nearly a third of the used parts business. These firms offer goods at a lower price than the recognized dealers without guarantees of condition.

► **Approval Authority**—Under the revised procedure manual on "Export and Import of Aeronautical Products," CAA will continue to approve exports by issuing a certificate (Form CAA 26). However, others may vouch for airworthiness:

• **Manufacturers** on their own products (new or used), along with accessories, parts and components. The manufacturers must be operating under a certificate or hold delegated authority.

• **Repair stations**, specifically authorized to process exports, on products for which they are rated under their CAA certificate.

Regulations make it clear that these parties "will be responsible for definitely determining the airworthiness and operational or functional acceptability of products, parts, components, assemblies and accessories."

► **Reliable Standards**—CAA's action follows efforts by some major suppliers to set up reliable standards.

For example, the Babb Co., largest dealer in surplus equipment, organized its own "known quality" program. Its major effort was to eliminate a list of more than 30 different quality descriptions applied to aircraft components.

Babb substituted four classifications: factory new certified, unusued certified, unused overhauled certified and used overhauled certified.

CAA certification is offered in all four classes for airborne equipment.

AIA Asks $500 Million for Tools

Panel says aircraft industry must have new machines to meet highspeed demands of emergency production.

Los Angeles—Some $500 million in new machine tooling is necessary to modernize the aircraft industry to the point where it will be prepared for emergency mobilization, reports the Machine Tool Panel of Aircraft Industries Assn. after two years study.

Equipment in plants and in the machine tool reserve is inadequate for today's requirements, the panel says. Production of highspeed aircraft requires tooling much more modern than that now in use.

The panel, including representatives from each of the major airframe plants, has drawn up specifications for these new and, in many cases, more automatic machines. The group is not yet in final agreement with the machine tool manufacturers on many of these specifications.

It will meet with the machine tool builders next month to reach the final decisions on this new family of machines.

► **Technological Revolution**—Among changes the panel is urging, according to chairman W. E. Brainard, assistant to the vice president-manufacturing at Hughes Aircraft Co., are:

• Reduction in the large number of machine types.

• Increased range of feeds, speeds and horsepower more adaptable to materials now used in aircraft.

• Easier accomplishment of setups.

• Easier adjustment during manufacture of parts.

The aircraft industry thus is leading a technological revolution that will spread to other industries as the tooling becomes available, Brainard believes.

The new tools required are within the known methods of solving horsepower, bearing and other problems, the panel reports.

"We are not talking about unknown methods," Brainard says. "We have avoided that. It is a question of design, not research."

► **Emergency Expansion**—Wartime production of such a bomber as the Boeing B-52 would require such an expansion in tooling for machining of some forged parts that it might well take the entire war to build the tooling, the panel chairman says.

The time to modernize tooling so that it can handle any emergency expansion adequately is now, Brainard implies.

The industry expects to submit requests for quotations on these new tools to machine tool manufacturers within the next 90 days, he says. These will be for additional tools to build new aircraft, not to replace present tooling.

► **Complex Methods**—Most of the present tooling is of early World War II vintage and needs replacement with tools that can work with the complex methods and newer material being used in new aircraft.

As examples of some of the new types of tooling the industry is recommending, he cites new bed-type mills that will feed at two to three times the present rate due to higher horsepower and spindle rpm., profiling machines with 360-deg. heads with depth control and twist that can reach surfaces peculiar to the airframe industry and a combination of these with tracer control.

"Combination of twist in tracer control machines is one thing the industry has sorely needed," Brainard says. "This type of machine will really throw its weight around in the aircraft industry."

► **Aerodynamic Demands**—The Machine Tool Panel was set up by the Manufacturing Methods Committee of AIA in 1952, when it became apparent that the increased complexity, weight and performance of aircraft was going to require the use of a vastly larger quantity of machined parts of a type not previously used in the aircraft industry.

Highspeed aerodynamics was demanding finer and thinner sections. New metals, alloys and complex configurations were posing difficult machining problems.

Machine tools developed around normal industrial requirements for common ferrous metals proved inadequate in power, speed and feed ranges to meet the demands of new designs and alloys.

A preliminary investigation by the panel showed urgent study was needed in the field of general purpose mills, horizontal boring mills, skin and spar mills, profiling and contouring equipment to bring them up to standards required in the aircraft industry.

Each panel member studied the problems in his own plant. At later meetings of the full panel, these were compiled and the specifications now being put forth by the group were drawn up.

► **Versatility**—One of the prime advantages of these new machines, Brainard says, will be their versatility. This will be of particular import to the subcontractor, whose machines will enable him to take on a wider range of jobs.

A compilation of the new specifications will be issued by the panel early next year.

Department of Defense and the Office of Defense Mobilization lent support to the coordinated program being carried out by the aircraft and machine tooling industries, anticipating its beneficial effect upon the machine tool reserve program of the military services.

Success of the program has been such that efforts will next be extended to a study of forming and stretching equipment, AIA reports. —WJC

White House Action Delays Airline Strike

A strike by the International Association of Machinists (AFL) against six major airlines has been delayed at least 60 days by White House appointment of an emergency board to investigate the dispute.

Until the President took action, the machinists were scheduled to strike last week against Capital, National, Northwest, Trans World, United and Eastern Air Lines. The strike would have effected 20,000 union members.

The machinist contract with the six carriers has been under negotiation since last May. In October, the National Mediation Board made an unsuccessful attempt to get the dispute submitted to arbitration.

President Eisenhower appointed the board under the authority of the Railway Labor Act, finding the dispute "in the judgment of the National Mediation Board threatens substantially to interrupt interstate commerce to a degree such as to deprive a section of the country of essential transportation service."

Under the terms of the Railway Labor Act, the board has 30 days to report its findings to the President, and there can be no strike for an additional 30 days after the board reports.

New Sperry System To Simplify Cockpits

A new "integrated instrument system," designed to make it easier for pilots to fly highspeed aircraft under IFR conditions and to simplify cockpit instrument panels, has been announced by Sperry Gyroscope Co.

Dual installations of the Sperry development will be made in Pan American World Airways' fleet of Douglas DC-7Cs as part of an improved version of the Sperry A-12 autopilot.

The system consists of three new panel instruments designed to give the pilot added information in a more pictorial form.

An added feature is a Zero Reader flight director incorporated into the "basic six" panel instruments. The new flight instruments include:

- **Combination horizon and Zero Reader indicator,** which gives the pilot pitch and bank attitudes plus flight director steering instructions.
- **Pictorial deviation indicator,** replacing the ILS panel instrument. This displays pictorially the plane's position relative to a new V-shaped localizer or VOR beam, magnetic heading and the ILS glide slope.

The instrument also incorporates the omni-radial bearing selector.

- **Radio magnetic indicator (RMI),** showing the aircraft's magnetic heading and the VOR or ADF bearing to two stations.

All of the new instruments come in the standard 3-in. diameter case size.

ARB Chief Scores British Copter Lag

London—Lack of progress in development of British helicopters came in for sharp criticism in a recent debate in the House of Lords, with Lord Brabazon of Tara, chairman of the Air Registration Board, leading the attack.

Lord Brabazon said the U.S. not only is "well ahead of us, but she is very active in development and production."

▶**'Long Overdue'**—"I am and always have been a great admirer of the British airplane industry," said the ARB chief, "but I maintain that on this subject a little more drive and activity is long overdue."

He was joined by several others in challenging the government's position on copter development. British European Airways chairman, Lord Douglas of Kirtleside, commented that he was not at all optimistic "about the present progress or development of helicopters in this country."

However, Lord Mancroft, government spokesman, pointed to the work being done on the Bristol 173, the Fairey Rotodyne and Hunting-Percival gas-turbine copter. He said military orders have been placed for "about 100" Bristols and that subsequently gas-turbine copter. He said military 12-27 passenger versions.

▶**Low Priority**—The debate resulted from comments by helicopter proponents that they were not satisfied with the government's support of rotary-wing development.

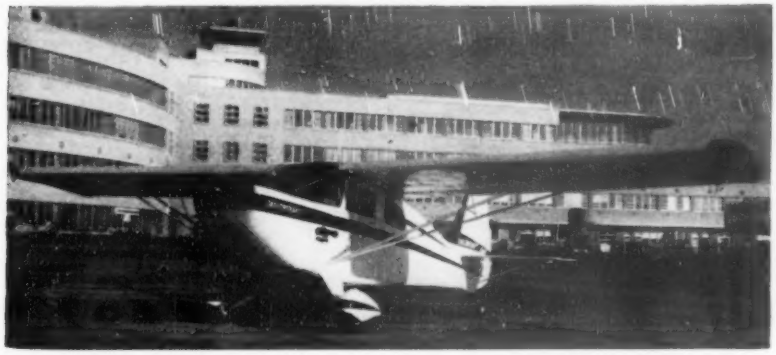
Funds for helicopter development have fairly low priority in the estimates of the British Air Staff, a government spokesman indicated, since this is "a requirement which they do not really want themselves and which is required by a sister service, the Army."

One suggested solution for obtaining funds: common pool to which all three services would contribute.

▶**Proved Types**—Lord Brabazon said Westland Aircraft, Ltd., now building Sikorsky helicopters under license, should be given an order immediately for the twin-engine S-56 so Britain could gain experience on proved types.

He said helicopter development should not be sidetracked by the feeling something better, like the Rolls-Royce vertical riser type, is on the way.

"I should like to be rescued at sea by an ordinary helicopter," he told the House, "but I do not know if I should like to be rescued by the Rolls-type machine, with a red hot blast coming



Taylorcraft Produces Plastic-Covered Planes

Reinforced Fiberglas plastic is extensively used in three new models of light aircraft on the production line at Taylorcraft, Inc., Conway, Pa. First of the new types is shown getting set for a flight test. The fuselage is made of two plastic shells joined over a tube-steel structure; the wing shells cover a spruce and aluminum framework. In addition, plastic is used for the seats, doors, fuel tanks, wheel pants, engine cowl, instrument panel and other components. Helium-gas and electricity are used to bind the Fiberglas and aluminum sections. Current output will be one plane a day. This could be increased to five daily with present facilities, the company says. Models and prices: Ranch Wagon, 225-hp. Continental engine, about $9,000; Sky Liner, 145-hp. Continental, about $6,000, and the Topper, 225-hp. Continental, about $9,000.

down on me. I would rather be drowned than burnt."

In a discussion on the relative merits of new U.S., large copters such as the S-56 and the Piasecki H-16, Lord Mancroft, speaking for the government, claimed these types were some time off from being used commercially.

BEA's Lord Douglas countered: "At least those two aircraft are flying now. The Fairey Rotodyne will not be in the air for another two or three years."

15 Aircraft Firms Win Tax Writeoffs

Office of Defense Mobilization reports a $1.1-million expansion of research and development facilities by Lockheed Aircraft Corp.'s Missile Systems Division was the largest aviation project approved for the Oct. 21-Nov. 3 period.

ODM authorized accelerated tax writeoff benefits on 60% of the project under its program to stimulate private expansion of defense facilities.

Accelerated tax amortization on 60% of an $85,910 expansion at the same plant for ordnance production also was approved.

Other certificates of necessity and percentage allowed for accelerated tax amortization included:

AiResearch Manufacturing Co., division of the Garrett Corp. Los Angeles, military aircraft components, $478,055 certified with 65% allowed.

Fairchild Engine & Airplane Corp., Stratos Division, Bay Shore, N. Y., military aircraft components, $478,055 certified with 65% allowed; Aircraft Division, Hagerstown, Md., military aircraft, $29,622 certified with 65% allowed.

Bendix Aviation Corp., Scintilla Division, Sidney, N. Y., aircraft components, $18,248 certified with 65% allowed.

Old King Cole, Inc., Louisville, Ohio, aircraft components, $93,180, certified with 50% allowed.

Burnett Estes, Garland, Tex., scientific instruments for defense, $121,500 certified with 40% allowed.

Cessna Aircraft Co., Wichita, Kan., military aircraft, $34,658 certified with 60% allowed.

Avien-Knickerbocker, Inc., Aviation Engineering Division, Woodside, N. Y., scientific instruments for defense, $3,186 certified with 70% allowed.

Lockheed Aircraft Corp., Burbank, Calif., military aircraft, $63,160 certified with 60% allowed.

Northrop Aircraft, Inc., Hawthorne, Calif., military aircraft, $46,689 certified with 60% allowed.

Glenn L. Martin Co., Middle River, Baltimore, military aircraft, $43,925 certified with 60% allowed.

Aircraft Products Co., Bridgeport, Pa., military aircraft components, $7,088 certified with 80% allowed.

S-K-S Die Casting Co., Berkeley, Calif., aircraft parts, $227,740 certified with 65% allowed.

Curtiss-Wright Corp., Wright Aeronautical Division, Wood-Ridge, N. J., military aircraft engines, $455,719 certified with 50% allowed.

Consolidated Industries, Inc., West Cheshire, Conn., steel, titanium and aluminum aircraft forgings, $54,910 certified with 65% allowed.

Kearfott Co., Little Falls, N. J., precision scientific instruments for defense, $81,650 certified with 65% allowed.

Prototype Caravelles Need $7.8 Million

(McGraw-Hill World News)

Paris—The French Parliament has been asked to appropriate approximately $7.8 million for completion of the two prototypes of France's first jet transport, the sweptwing twin-engine Caravelle.

Request was included in the 1955 civil aviation budget submitted by Jacques Chaban-Delmas, Public Works and Transportation Minister.

The S.E. 210 Caravelle is designed to carry 70 passengers. Its maximum range will be 2,300 mi., with planned speed of 470 mph. Its distinctive design feature is the location of the two Rolls-Royce Avon R. A. 16 engines far back on the fuselage.

Other details on the Caravelle: span 113 ft.; length 103 ft.; weight fully equipped 41,800 lb.; maximum payload 17,600 lb. Normal payload based on a 6,000-ft. runway will be 15,400 lb. over maximum distance of 1,550 mi.

The two prototype Caravelles now are being constructed by the Societe Nationale de Constructions Aeronautiques du Sud-Est (Sncase) in cooperation with the Sncaso (Sud-Ouest). It is expected that they will be completed by the end of February, that first flights will be made in May or June.

GE Says Turbines Best for Copters

Fuel economy, lower noise level, durability and reliability were listed as major advantages of turbine engines for helicopters by H. T. Hokanson of the General Electric Co., manager of that company's T58 project to produce a suitable rotary-wing engine for the U. S. Navy.

Hokanson told a Washington meeting of the American Helicopter Society that gas turbines will give copters twice the power they can get out of piston engines of comparable weight.

First cost, he said, has not been a primary consideration in military power units for combat airplanes but must be kept down for use in helicopters. He predicted that a turbine can be made that will not cost more in dollars per horsepower than competing piston engines.

Hokanson told the group that use of turbines also will cut fuel costs, reduce noise and give better performance.

Small Firms Get 21% Of AF Subcontracts

The percentage of Air Force procurement dollars passed along to small business by major prime contractors was about 21% in both fiscal 1953 and 1954, Kennard Weddell, chief of the Office of Small Business at USAF headquarters, reports.

Weddell says that in 1953 large prime contractors got a total business of $13,599,544,000 and passed along 52% of the money to all kinds of subcontractors. The share of small business firms, those employing fewer than 500 persons, was $2,856,382,000 or 21%.

In fiscal 1954 the large prime contractors received orders worth $5,135,717,000 from the Air Materiel Command, and again about 21%, or $1,078,800,000, of this eventually went to small business. Weddell says there is no evidence that the percentage of total dollars going to small business had changed.

His statement was issued to correct figures appearing in AVIATION WEEK (Oct. 11, p. 22).

Ford Ships First Afterburner J57 Jet

A dozen engineers, shoulder to shoulder, just about cover the length of the first J57 turbojet with afterburner produced by Ford Motor Co.'s Aircraft Division, Chicago. The company, building the new model under Pratt & Whitney Aircraft license, sent the first engine, designated J57-F-7, to North American Aviation, Inc., for installation in the F-100 Super Sabre. Its first production J57 was delivered last April after tooling for more than 18 months. Ford has USAF contracts for the 10,000-lb.-thrust-class jet extending into 1957. It previously delivered 3,079 P&WA R4360s made under license.

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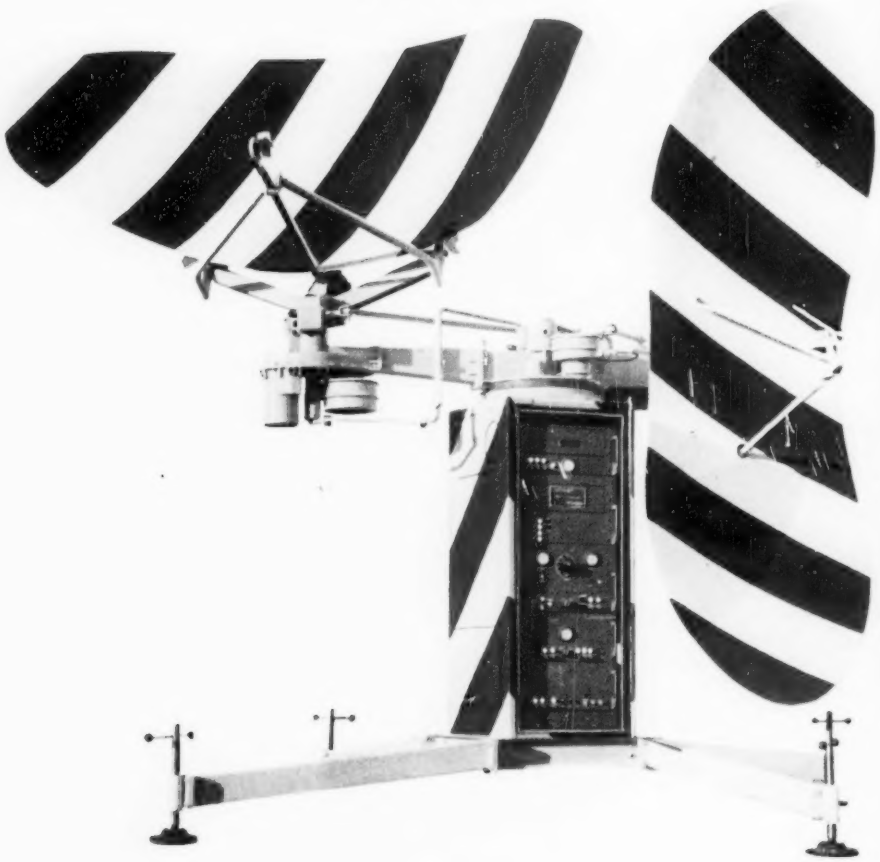

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Picket Planes: Offense, Defense Threat

By William J. Coughlin

Honolulu, T. H.—Navy and Air Force crews now are putting WV-2s and RC-121s into operational use in the Pacific, developing new concepts in the use of radar for airborne offense and defense.

The planes are military versions of Lockheed Aircraft Corp.'s Super Constellation transport, bulging with the odd-shaped radomes that contain antennas for search and height-finding radar.

USAF and Navy have concentrated on development of different potentialities of these flying radar stations. In general, it might be said Air Force emphasis has been on defensive capabilities of the aircraft, while the Navy has been more interested in its offensive uses.

▶ **Operational Squadrons**—AVIATION WEEK staff members recently logged more than 30 hr. flying with Air Force and Navy operational squadrons in California and Hawaii to study this post-World War II radar development.

USAF RC-121Cs and RC-121Ds are assigned to the new 8th Air Division at McClellan Air Force Base, near Sacramento, Calif. First of the Navy's WV-2s recently were delivered to Airborne Early Warning Squadron 1 (VW-1) at Barber's Point Naval Air Station, Oahu, Hawaii.

Eventually, both Air Force and Navy will activate similar units in the Atlantic area.

Differences between the USAF and Navy versions of the radar planes are minor.

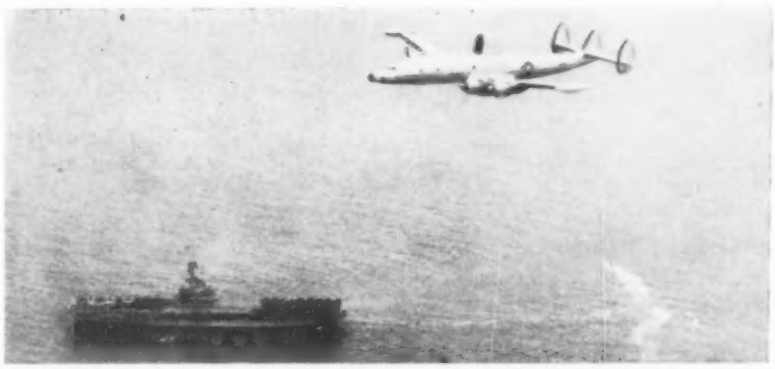
▶ **'Careless Connie'**—The radar Super Connies probably are the most distinctive craft in the air.

Height-finding radar antenna rises 8 ft. from the top of the fuselage in a radome resembling a shark's fin. Search radar antenna is contained in a huge bathtub radome swelling grotesquely from the underside of the fuselage. This results in the pregnant appearance that has given the plane the nickname of "Careless Connie."

Inside the plane, the dim interior of the windowless radar section, packed with more than six tons of avionics gear, gives the impression of the interior of a submarine rather than an aircraft. Both sides of the aisle of this main cabin are lined with radar consoles, each with a comfortable swivel chair in front of the scope.

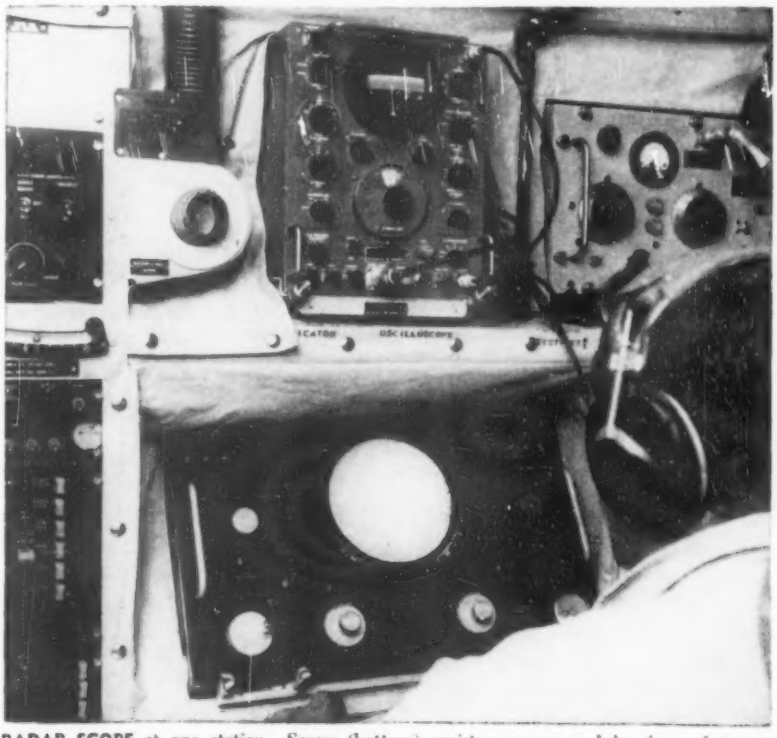
▶ **Detecting, Tracking**—The orange, blue and green lines on these radar scopes, pulsating in the semi-darkness, can perform operations that amaze the uninitiated.

The experienced radar operators can



SUPER CONNIE WV-2 passes over USS Kearsarge, which holds planes ready for "scramble."

COMBAT INFORMATION CENTER aboard WV-2 plots radar contacts, will direct defenders.



RADAR SCOPE at one station. Scope (bottom) registers ranges and bearings of target.

track other aircraft, determining speed, height and distance. They can follow ships, detect submarines, analyze weather, track and control missiles.

Elaborate computers can determine intercept courses for aircraft flying at different speeds in different directions. Height-finding radar can zero in on any of many targets in the area.

Scope patterns can be relayed via television to other aircraft, to ground stations or to ships. Electronic countermeasure devices can jam enemy radar.

Offense Mission

One of VW-1's first operational missions with its new radar planes demonstrated the offensive use to which these flying radar stations can be put by the Navy.

VW-1, under Cmdr. Adrian H. Perry, was given the task of locating the "enemy" carrier Kearsarge in the waters off Hawaii and directing offensive strikes against it.

The squadron was to devise the strike tactics and control the waves of striking aircraft that were to test the defense capability of the carrier against this type of airborne-directed attack.

▶ **Complex Task**—The 31-man crew of the WV-2 was told at briefing that the carrier's last known position was somewhere south of Oahu.

The first job ahead of them as the big radar plane lifted off the runway at Barber's Point in the pre-dawn darkness was to locate the carrier on their radar screens, while at the same time staying out of range of the carrier's own radar. The carrier's defensive air patrol could score a quick "kill" on the unarmed Super Connie if its position were discovered.

Once the carrier was spotted, there began the complex task of directing the fighter strikes against it. Radar gear of the Super Connie would enable the crew of the WV-2 to track the carrier's combat air patrol and vector their own planes into the ship on a path that would avoid interception by those of the enemy during the attack.

▶ **Slashing Strikes**—Land-based Marine F2Hs and F9Fs from Kaneohe Naval Air Station, guided by the electronic eyes and brains of the circling WV-2, slashed across the Kearsarge unintercepted at an altitude of 1,000 ft. in an attack from the east. Seconds later, P2Vs roared over from the west.

As the first two waves neared the Kearsarge, a third wave was jamming the carrier's own radar gear as it approached from the north. This attack consisted of four TBMs engaged in passive jamming with chaff and two specially equipped AD Skyraiders actively jamming electronically. This wave also hit the carrier unintercepted.

The WV-2 then vectored its striking aircraft back to their land bases before returning to its own field.

▶ **Split-Second Timing**—It was a convincing demonstration of the split-second timing with which this flying electronic mastermind could direct air war in the future. It all took place in the dimly lit cabin of the Super Constellation, with the men watching and guiding the action through their radar scopes and radio circuits while circling out of range of the carrier.

When the pilots, navigators, flight engineers, radar controllers, radio and TV operators, electronic countermeasures officers and maintenance specialists filed out of the aircraft after its return to Barber's Point, blinking in the brightness of the early morning Hawaiian sunlight, they had not seen the carrier or any of the aircraft involved except as tiny blips on their radar.

To them, the battle they were directing had appeared only as flickering points of light in the darkness of the WV-2's main cabin.

Navy Radar Aircraft

The history of the Navy's radar aircraft is brief but impressive, as reported by Lt. Cmdr. Alex Wilding, combat information center officer of VW-1.

It originated from the use of shipboard radar, with the first shipboard

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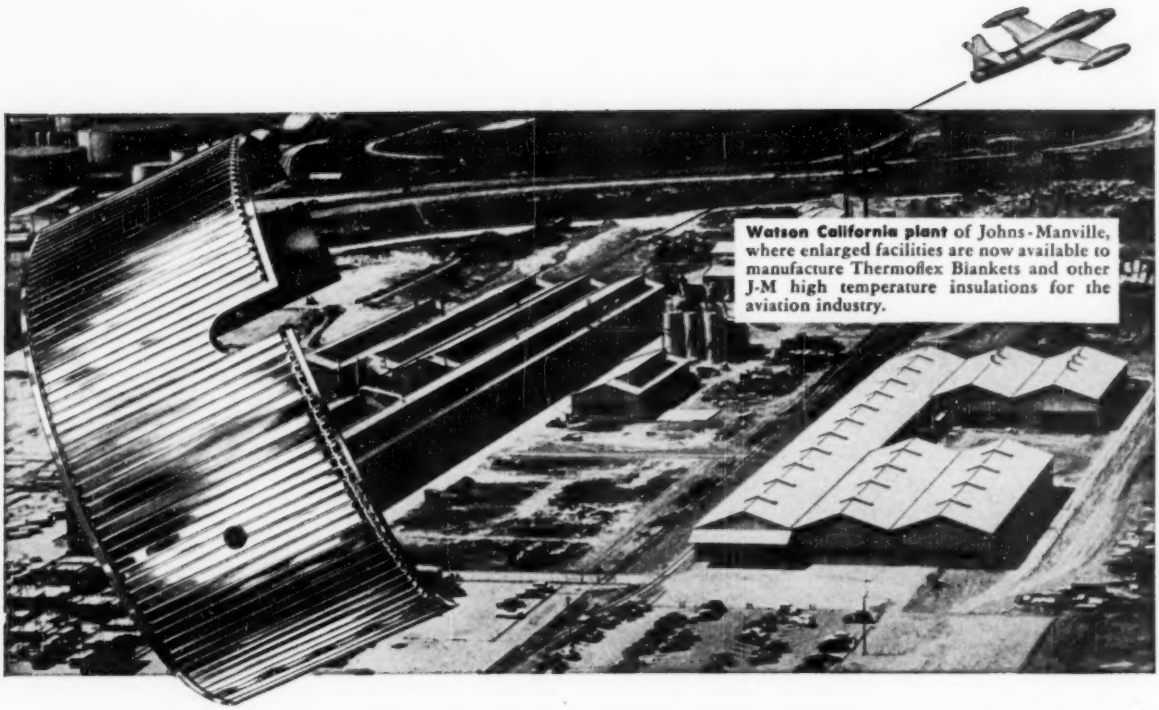

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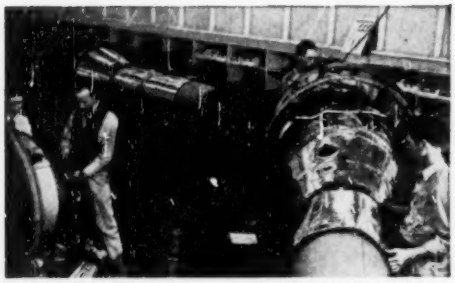
Johns-Manville expands production to make Thermoflex Insulating blankets



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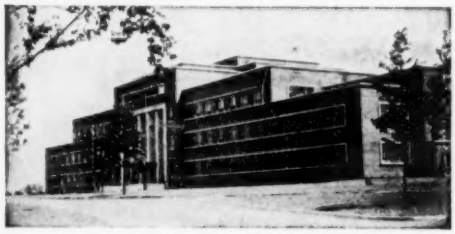

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combat information center installed aboard an Essex-class carrier in 1943.

▶**Under the Net**—It was during the attack on the Japanese-held Marshall Islands that the need for airborne radar first became apparent.

Japanese torpedo bombers, flying low on the water, hit the carrier undetected by the radar.

"When everything opened up," Wilding remembers, "we rushed to the ports and saw them shooting down torpedo bombers. We yelled, 'They're shooting down our own, they're shooting down our own.' Then we saw the meatballs. We rushed back to our radar to see if the operators had been asleep. But the radar had failed to pick the Japs up because they had come in on the water under the radar. Fortunately, the Japs didn't realize what they had done and it was not repeated."

▶**CIC Concept**—Radar proved its true value in the First Battle of the Philippine Sea when three waves of 323 Japanese planes were shot down on intercepts directed by the combat information center. None of the attacking aircraft reached the carrier.

After that, the Navy began to delegate more control responsibility to the combat information center, in the start of a concept that now is being fully developed with the WV-2.

As U. S. forces moved closer to Japan in their advance across the Pacific, the Japanese learned for the first time their planes could come in under shipboard radar.

The Navy then began a "crash" program to develop airborne radar to overcome this line-of-sight limitation. First test was with an APS-20 radar unit in a TBM off Cape May, N. J.

▶**Airborne CIC**—Meanwhile, radar officers were pressing for an aircraft not limited to mere detection. They believed it also should be a complete airborne CIC to handle control functions, direct antisub warfare and fill a multitude of other uses.

The result was a full Navy program for the development of airborne radar. Although the urgency was removed from the program by the end of the war, VX-4 was activated as an airborne radar unit in the Navy's Operational Development Force. While air detection was not as good as hoped, VX-4 discovered its radar was extremely effective against snorkeling submarines.

It was this that first convinced the Navy it should give full backing to the program.

▶**First Squadron**—Airborne Early Warning Squadron 1 was established in 1948 at Ream Field, San Diego, Calif., and in June 1952 was shifted to the Hawaiian area with PB-1W patrol aircraft.

It also has trained with the WV-1, an earlier model of the WV-2 used to pioneer Navy's airborne radar techniques during the past three years.

In maneuvers in the Western Pacific in 1954 in which more than 100 ships took part, VW-1 was permitted to dictate doctrine in the development of air tactics employing airborne radar.

"For the first time," says Wilding, "the task force commander had complete knowledge of what was going on in the air and on the sea around him."

Since then, he says, VW-1 has had more requests than it can handle to work with carriers, amphibious forces, convoys and submarine forces.

In addition to its antisubmarine warfare use, it also should be noted that the WV-2s can operate offensively with submarines, positioning them for attack by tracking both ships and submarines on its radar scopes.

▶**Growing Concept**—The doctrine of control and coordination from the air still is being developed. The WV-2s can operate independently or as a team with CIC units, either shipboard or airborne.

Eventually, the members of VW-1 believe, control and coordination of fleet operations may take place entirely from these flying radar stations.

That is one of the main tasks of VW-1 today—to perfect techniques and procedures for operating with task

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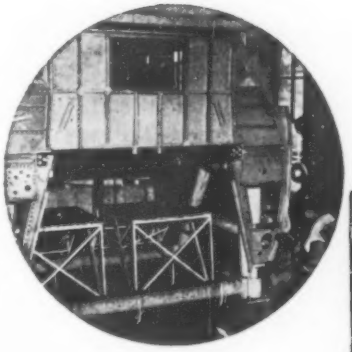

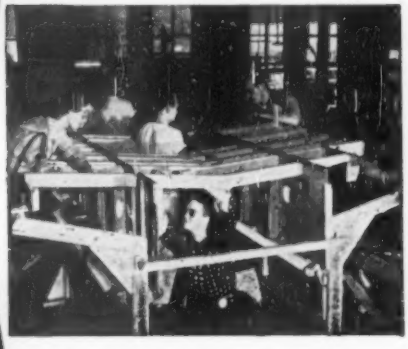

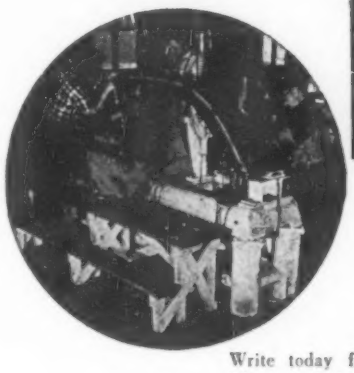

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Air Force Tests

USAF thus far has expressed interest in the RC-121 for two reasons:

- Its capability as a high-altitude radar picket plane to be used for spotting enemy aircraft as they approach the U.S., long before they are within range of ground radar stations.
- Its effectiveness as a fighter control center for either defensive or offensive operations.

▶ **Limited GCI**—During the Korean war, radar deficiencies limited the effectiveness of Air Force GCI (ground controlled intercept) operations in the MiG Alley fighting. USAF thought the Navy developed airborne radar might provide an answer to the problem.

A series of tests was run in the U.S., with Air Force jets making simulated strikes at a Navy radar plane. Every strike was detected and intercepted under the direction of the airborne radar while the jets still were at least 25 mi. from the Navy aircraft.

Air Force announced a production contract for the radar planes in August 1953 (AVIATION WEEK Aug. 24, 1953, p. 17).

▶ **U.S. Picket Lines**—One of the primary missions the Air Force has in mind for its RC-121Cs and RC-121Ds (the Ds are equipped with wingtip tanks for greater range) is that of maintaining an around-the-clock airborne patrol of the approaches to the continental U.S. This will begin when the radar planes are available in sufficient numbers.

The 8th Air Division, activated last May under the command of Brig. Gen. Kenneth H. Gibson, will have about 2,500 officers and airmen on both coasts when it is fully operational and will be equipped with 30 aircraft per squadron.

The men of the 4701st Aerial Early Warning and Control Squadron at McClellan, meanwhile, are using their aircraft in a combination training and operational program.

▶ **Airborne Station**—The radar picket planes will be used to extend the Air Force Coastal Detection Zones well out to sea. Long range endurance of the RC-121 will enable the aircraft to remain aloft on patrol for more than 24 hr. without refueling.

It thus becomes in Air Force use an airborne radar search station and fighter-interceptor control center with duties similar to those of land stations.

In fact, if enemy action should put a ground station out of commission, one of the flying radar stations could be assigned to orbit in the area to fulfill the same functions.

▶ **'Barrier' Patrol**—A flight in one of the 8th Air Division aircraft indicates what might happen if one of the RC-121s detected an unidentified blip while patrolling its sector off the coast. Each sector is designated a "barrier."

One difference between Air Force and Navy operation of the aircraft, incidentally, is found in the fact that the plotter and the radar observers manning the search sets in the USAF aircraft are enlisted men. In the Navy, they are officers, indicating the greater emphasis on control functions.

The sets in the RC-121s used to direct fighter planes on intercept missions are manned by Air Force officers trained as intercept directors.

A senior director sits at a radar switchboard from which he is able to communicate by intercom with anyone in the crew, set up priorities for use of the height-finding radar and monitor any scope in the plane.

Upon sighting of an unidentified blip, the radar operator passes the information to the plotter, who fixes its position on a geographical grid and relays this data to a teller, who radios the position to coastal radar.

If the target cannot be identified as friendly, interceptors are scrambled and vectored to meet the unidentified aircraft. The intercept director employs his radar to guide the interceptor to the unidentified aircraft.

Meanwhile, other sets can scan dif-

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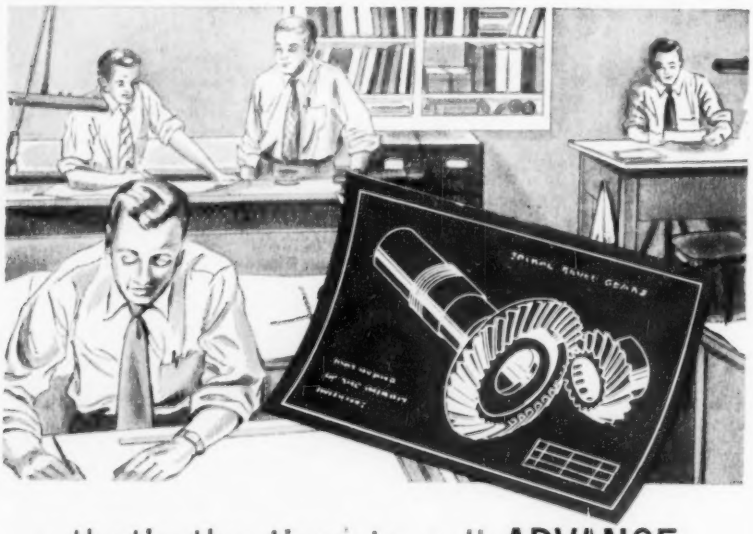

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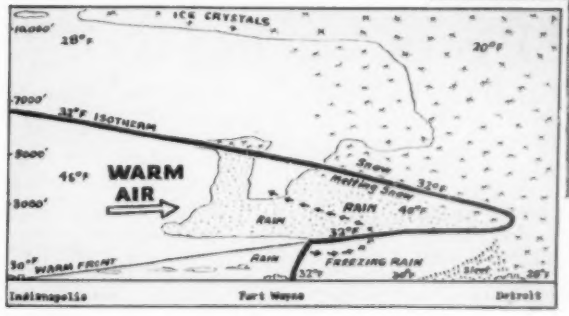
FLY WEATHER-WISE

These weather items prepared in consultation with the United States Weather Bureau

Don't depend upon your take-off propeller blast to clear your wings of snow. Even dry, powdery snow may have melted and re-frozen underneath on the wing.

On the ground, get your plane into a hangar on cold, rainy days. A quick drop to near 32° F. will cause rain to freeze on impact with the wings.



Checking fog possibilities, study weather reports upwind from the station in question. If Dew Points are higher upwind, chances are the fog will increase when the wetter air moves in.

Under an overcast sky in light rain with temperatures near 32° F., freezing rain is apt to be encountered. If not equipped for all weather flying, land immediately. If this is not possible, try climbing to warmer temperatures in the over-running rain clouds.

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Canadian Representative—Railway and Power Engineering Co., Montreal. Offices throughout Canada.

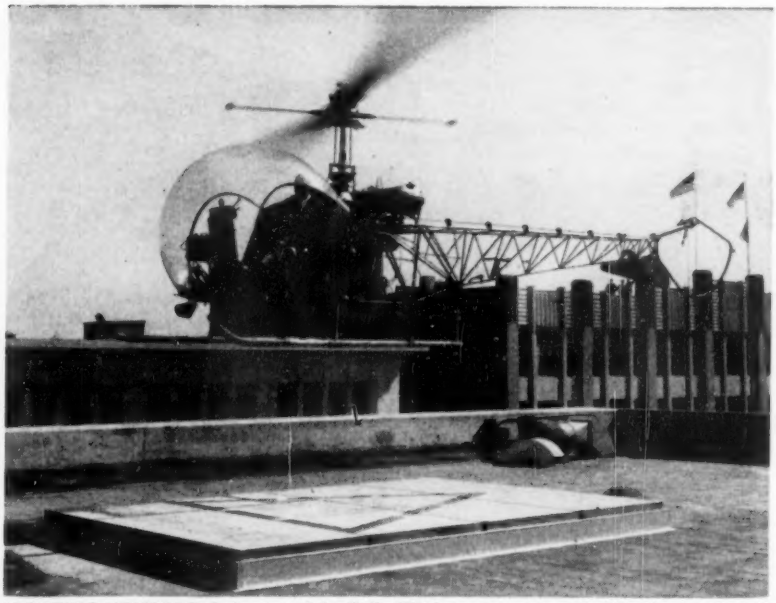
ferent sectors or carry out weather reconnaissance in the area.

The intercept director is responsible not only for guiding the fighter to the target but for returning it to base before its fuel supply is exhausted.

▶ **Long Hours**—Special provisions are made aboard the RC-121s and WV-2s for comfort of the crew during long hours in the air. These include bunks for relief crews, a galley with grills, a refrigerator and running water.

The aircraft is pressurized for 10,000-ft. cabin altitude at 25,000 ft. Speed is about 300 mph, although cruising usually is much slower.

Dimensions are those of the basic Lockheed Super Constellation: 123-ft. wingspan and 116-ft. length. Engines are the same as those of the Super Connie: four Wright 3,250-hp. Turbo Compounds.



FLOATING HELIPORT, being tested by Bell 47D-1 copter, costs only $5 a foot to install.

Heli-Float Passes Landing Tests

Phoenix, Ariz.—The Heli-Float, a new type heliport designed to make rooftop landings possible without expensive building changes, was demonstrated here last week.

The Heli-Float employs the basic principle of hydrostatic pressure—even distribution of weight through water. It is the result of a three-year research and development program by Alan C. Thomson of Thomson Research Co., Mesa, Ariz.

A Bell 47D-1 helicopter made several test landings on the Heli-Float atop the four-story Hanny's building in downtown Phoenix.

▶ **Simple Structure**—Until now, roof heliports often have involved expensive structural changes. Only change to the test roof, which has normal stressing of about 40 lb. per square inch, was construction of a low-wall wooden tank capable of holding the minimum of 2 in. of water.

The float measures 11 by 16 ft., and the tank is slightly larger. Complete installation weighs 900 lb.

The model float is an 8-in. thickness of honeycomb, designed to support 30,000-lb. per square foot, plated on bottom and top. Structural honeycomb is a product of Hexcel Products Co., Oakland, Calif.

▶ **Heaviest Copters**—Thomson says platforms can be made to handle the heaviest helicopters. "Increased platform areas will be necessary," he adds, "and this will distribute the increased weight of both platform and helicopter over a greater area safely."

Features of the Heli-Float:

- **Easy installation** on large or small flat-roofed buildings. A 40-ft. square would be adequate for a single machine, while the larger Heli-Floats would extend several hundred feet.
- **Fireproof barrier** between the Heli-Float and the building.
- **Noise absorption** by the float and the liquid, assuring a quiet interior.
- **Light weight.** A 100-by-200-ft. platform would weigh 1,400 tons in concrete, compared with 50 tons in the floating platform.
- **Economy.** Thomson estimates that in full production a Heli-Float can be installed at $5 a foot, compared with $22 for a typical concrete installation.

Facts about *HELICOIL* inserts in the aircraft industry

What they are

*Heli-Coil** screw thread inserts are precision-formed coils of stainless steel or phosphor bronze wire. Wound into tapped holes, they form permanent non-corrosive, strip-proof threads of astonishing strength.

How they cut weight

Threads tapped in aluminum or magnesium when protected by *Heli-Coil* inserts are much stronger, therefore you can use smaller, fewer, shorter cap screws for required strength. Fewer or shorter cap screws mean savings in fastening-weight, through lighter bosses, thinner flanges, and thinner wall sections.

What they are for

AS ORIGINAL COMPONENTS: *Heli-Coil* inserts are used to provide stronger, lighter fastenings, corrosion-proof, wear-proof, threads in all assemblies. Thus you find *Heli-Coil* inserts throughout aircraft engines, airframes, and accessories, from the heart of jet engines to skin inspection panels.

FOR PRODUCTION SALVAGE: When conventional tapped holes are damaged in production, restore them on the line with *Heli-Coil* inserts. Get better-than-original strength with no increase in screw size and no tell-tale signs of re-work.

FOR SPEEDY REPAIRS: When tapped threads are fouled up by wear, stripping, or corrosion in service, renew them in minutes on location in shop or field with *Heli-Coil* inserts.

No welding—no plugging—no secondary machining—no oversize screws.

For useful tips, use the coupon for free subscriptions to *"Heli-Coil"* in which we publish latest news on what others are doing in your field.

How they work

Holes are drilled and tapped as you do for ordinary threads—then *Heli-Coil* inserts are wound into tapped holes by hand or power tools. Install in a few seconds, assure thread protection forever. Can be used in any metal, wood or plastic.

No other method is so simple, effective and practical.

Heli-Coil inserts improve the end product, cut rejects, salvage threading errors.

All sizes and types

Available for National Coarse, National Fine and Unified threads, pipe threads and spark plug threads. They are made in all standard sizes and lengths for assemblies requiring Class 3, 3B, 2 or 2B firs.

Best time to put *Heli-Coil* inserts benefits to your use is right at the designing board, as many leading manufacturers are doing. But to convince you of their many advantages ask for a working demonstration right on your production line. Write today! Complete information and engineering data is available in the *Heli-Coil* catalog. Use coupon!

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how to GAIN STRENGTH, SHED WEIGHT yet CUT COSTS with HELI-COIL* screw thread inserts

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Here's how they help you shed *weight*—Because they are strong, you can use fewer or smaller fastenings. Because they end the need for solid bushings you can use smaller bosses and flanges.

HERE'S PROOF

Look at these facts—examples of the aircraft industry's growing acceptance of *Heli-Coil* Inserts:

General Electric has jumped the use of *Heli-Coil* Inserts 4 to 5 times in the J73 over the J47. In the forward frame alone the number has climbed from approximately 50 to 168.

Pratt and Whitney pioneered the use of *Heli-Coil* Inserts in spark plug openings in reciprocating engines. Today they are the largest user for this purpose.

Call in your *Heli-Coil* engineering representative for a discussion of how you can gain strength, reduce product weight, and cut costs with easy-to-use *Heli-Coil* Inserts in airframes, engines and component parts.

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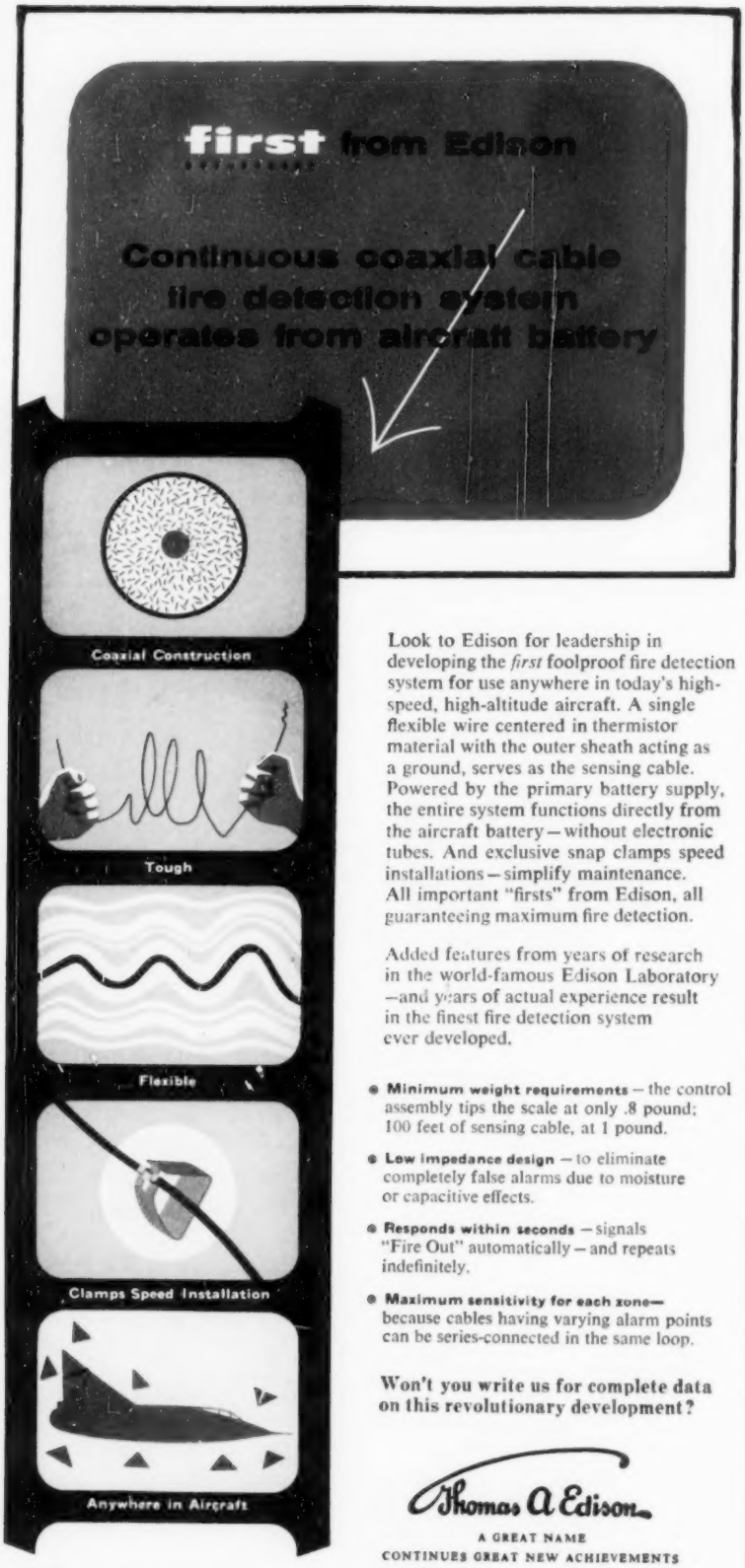

Look to Edison for leadership in developing the *first* foolproof fire detection system for use anywhere in today's high-speed, high-altitude aircraft. A single flexible wire centered in thermistor material with the outer sheath acting as a ground, serves as the sensing cable. Powered by the primary battery supply, the entire system functions directly from the aircraft battery—without electronic tubes. And exclusive snap clamps speed installations—simplify maintenance. All important "firsts" from Edison, all guaranteeing maximum fire detection.

Added features from years of research in the world-famous Edison Laboratory—and years of actual experience result in the finest fire detection system ever developed.

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Small Business Key To Air Lead: Navy

Los Angeles—Small business is the key to continued U. S. industrial leadership, Navy small business specialist B. A. Friedman told a recent meeting of the Aircraft Parts Manufacturers Assn., adding that without it, "the aircraft industry would fail us in an emergency."

Cmdr. H. H. Blackman, head of the Navy's Los Angeles procurement office, told the group that "if the small aircraft industries are not kept intact, our country's ability to keep enemies from our soil will be seriously weakened."

▶ **Decentralized Buying Program**—He pointed out that the Navy has decentralized its procurement program and now maintains purchasing offices in every geographic production area in the U. S., Hawaii and England. But he warned:

"While one of the major purposes of the local procurement program is to see that small business gets a fair share of its contracts, there is no place for the business opportunist. Each company hoping to participate in the Navy's defense contracts must be able to stand up under the light of investigation as to finances, experience and facilities."

Cmdr. Blackman said the reason for the de-centralization was the realization that it is impossible for any central government purchasing agency to evaluate properly the facilities and capabilities of the thousands of small firms in the aircraft industry.

▶ **Lion's Share**—Friedman told the group that California ranks second in the nation in funds expended by military procurement offices during the past four years.

"New York has received 15.4%, while California follows closely with 14.7%, mostly designated to Southern California industries," he said.

▶ **Mutual Problems**—Meanwhile, members of Small Defense Industries Assn., the other organization representing small business, met with representatives of Aircraft Industries Assn. and major airframe companies to discuss mutual problems, and agreed that:

- Monthly meetings will be held until a sound understanding between the primes and SDIA has been established.
- SDIA will submit questions and problems through AIA, which in turn would poll the primes. If the problem requires further discussion, it will go on the agenda for the next meeting.
- Immediate objective is to plan and put into effect a program of education primarily to broaden the effectiveness of handling work for the primes, such as quality control, planning and scheduling of production and standardization and simplification of methods.

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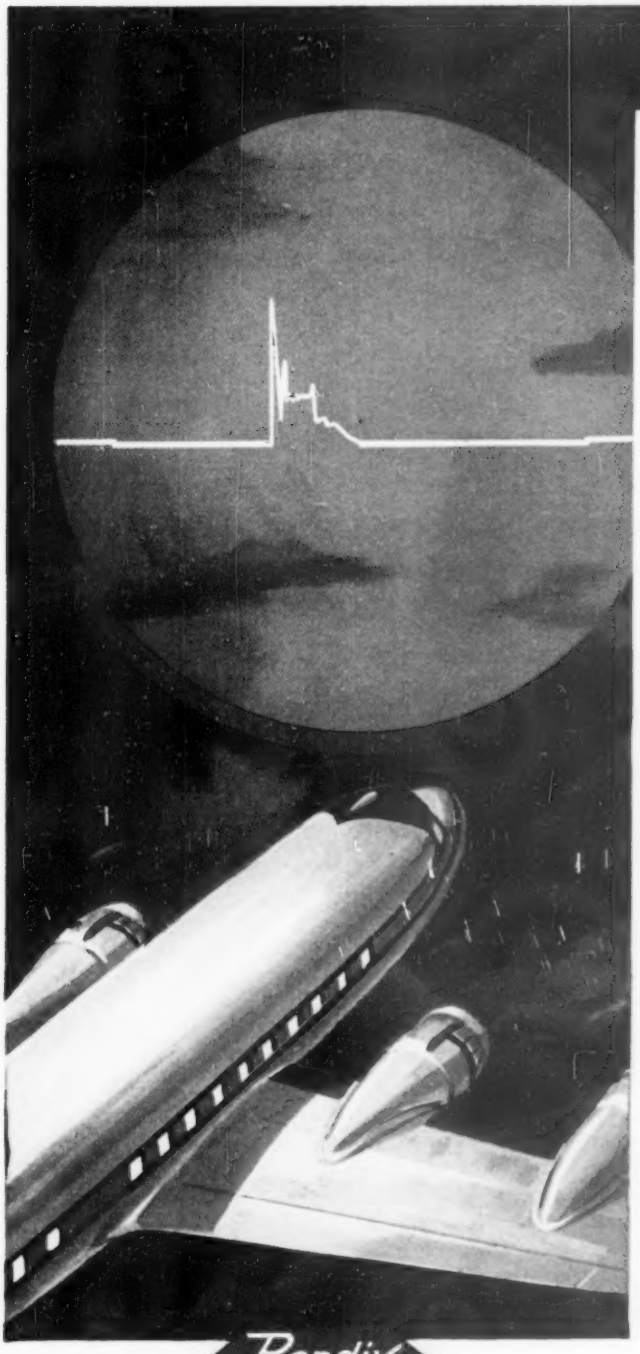

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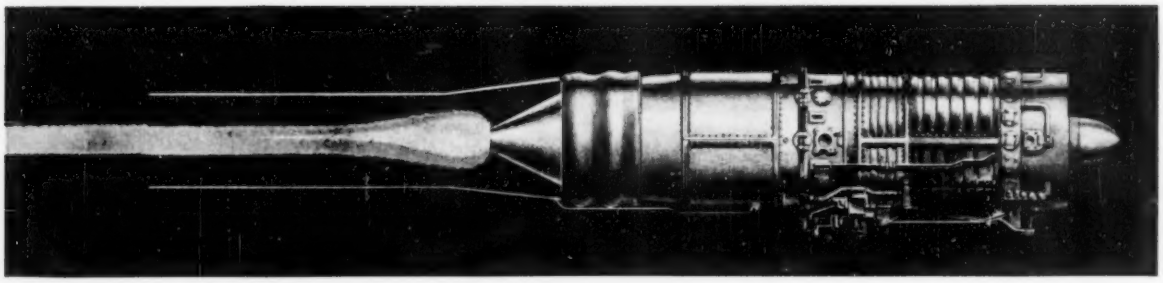

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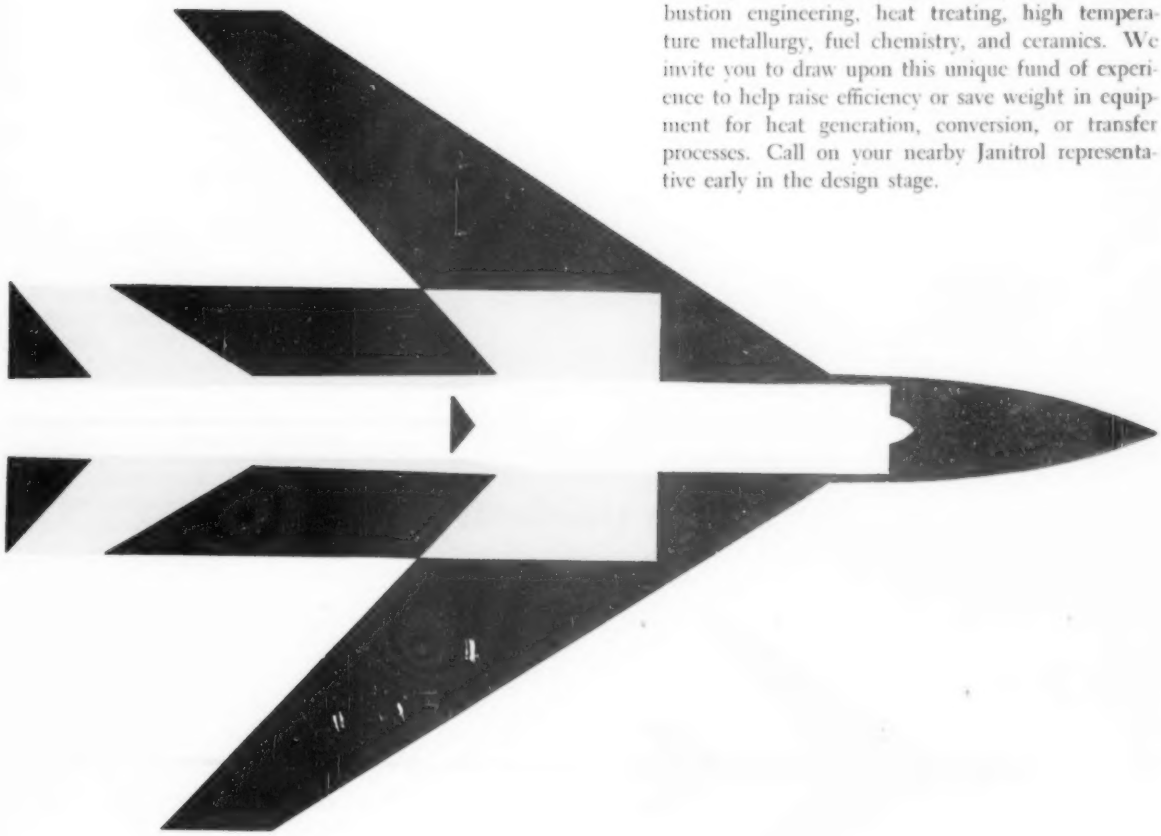
This development is a concrete example of Janitrol pioneering—another of Janitrol's many "firsts" which include the whirling flame heater, the radiant tube heating principle—hot rod wing anti-icing—purge gas generators—canopy seal regulators—and the dimple plate construction of heat exchangers. The background necessary for these contributions has not been acquired overnight: rather, it goes back over 37 years and spans many fields of combustion engineering, heat treating, high temperature metallurgy, fuel chemistry, and ceramics. We invite you to draw upon this unique fund of experience to help raise efficiency or save weight in equipment for heat generation, conversion, or transfer processes. Call on your nearby Janitrol representative early in the design stage.



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AMC, ARDC Officers Win New Promotions

Air Materiel Command and Air Research and Development Command officers figured prominently in a list of recent appointments to temporary and permanent ranks of major general and brigadier general, announced by the White House.

Promoted to permanent major general: Samuel R. Brentnall, assistant chief of staff for guided missiles; Donald L. Putt, deputy chief of staff for development; William H. Tunner, commander of USAFE and Albert Boyd, commander of Wright Air Development Center.

To temporary major general: Merrill D. Burnside, deputy director of AMC for maintenance engineering; William T. Hefley, commander of the Sacramento AMA; Stuart P. Wright, commander of Rome Air Development Center; Frederick J. Dau, AMC director of supply and services and Samuel R. Harris, Jr., commander of Arnold Engineering Development Center.

Gens. Hefley, Wright and Dau also were named to the permanent rank of brigadier general. Others given this grade included: Floyd B. Wood, ARDC deputy commander for technical operations; Thetus C. Odom, commander of the San Antonio AMA; Lee B. Washbourne, assistant chief of staff for installations, and Sory Smith, former chief of public information and now commander of the Pacific Air Force.

Promoted to temporary rank of brigadier general: Tom W. Scott, AMC deputy director for supply & services; Milton F. Summerfelt, commander of Rome Air Force Depot; Donald D. Flickinger, ARDC director of research, and Don R. Ostrander, ARDC director of development.

BOAC Credit Plan

British Overseas Airways Corp., latest convert to the spreading pay-later movement, now is offering a combined plan in cooperation with British European Airways for deferred ticket payments in Britain for travel throughout the world.

BOAC's original pay-later plan, introduced Nov. 1, was available only for travel to the U. S.

The BOAC-BEA plan is similar to those of other airlines: 10% down payments.

Maximum payment period is six months if the balance is under $84, 12 months if $84 or more but under $280, and 21 months if the balance is $280 or more.

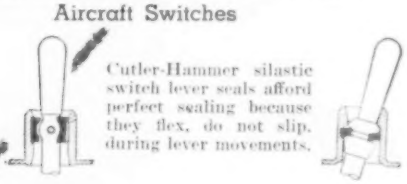
However, the credit plan does not apply for any tickets costing less than $56.

Cutler-Hammer Sealed Lever Switches for Aircraft

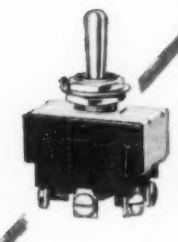
Another contribution to aviation progress by the engineers with a record of "firsts" in electrical control for aircraft

For 35 years Cutler-Hammer has been the major supplier of electrical control equipment designed exclusively for aircraft use. As aircraft progress revealed the need for better control, Cutler-Hammer has continually pioneered in the designs that have established the industry's standards. And now Cutler-Hammer leads again . . . with the first complete line of sealed lever aircraft switches. Designed to prevent the entrance of dust and sand, they are equally effective in stopping the entry of water *even during periods of switch operation.* With a durable silastic seal, these switches meet all requirements of MIL-S-6745 and/or JAN-S-23 . . . and, in addition, meet the sand and dust requirements specified under Procedure 1 of MIL-E-5272. These switches also meet the recommendations made in the "Report of Advisory Staff for Aircraft Electrical Systems." For complete data, write for your copy of Publication KSP-37. CUTLER-HAMMER, Inc., 1471 St. Paul Avenue, Milwaukee 1, Wisconsin.

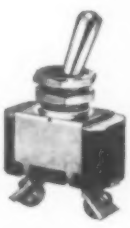
Typical Cutler-Hammer Sealed Lever Aircraft Switches



Cutler-Hammer silastic switch lever seals afford perfect sealing because they flex, do not slip, during lever movements.



AN-3027-1 ST50P C-H Bulletin 8820 K10 Double pole, double throw switch with "off" position.



AN-3021-10C-H Bulletin 8801 K16 Single pole, single throw switch with center "off" toggle position.

What you should know about Cutler-Hammer

Cutler-Hammer has long held the respect of the aircraft industry because this company has been *part* of the aircraft industry for 35 years. It has never been an opportunist supplier. It has *pioneered* the designs others have followed. It has sought to serve, not merely sell. It has been in the forefront of all cooperative activity in standardization and long-range planning. It has supplied complete *lines* of equipment, not merely the items of widest use and most profitable manufacture. Today, as for the decades past, Cutler-Hammer engineers are working closely with the aircraft industry's leaders . . . thinking ahead, planning, designing and building for the future. Here is the record:

1920 Cutler-Hammer designed and manufactured the first line of switches ever created specifically for use in aircraft.

1938 Cutler-Hammer designed and manufactured the first d-c power relay ever created specifically for use in aircraft.

1943 Cutler-Hammer designed and manufactured the first a-c power relay ever created specifically for use in aircraft.

1949 Cutler-Hammer started development of the first environment-free power relays for use in aircraft.

1953 Cutler-Hammer submitted samples and certified test reports on the first hermetically sealed power relay to WADC and Bu. Aer. Cutler-Hammer configuration adopted as industry standard by ASG.

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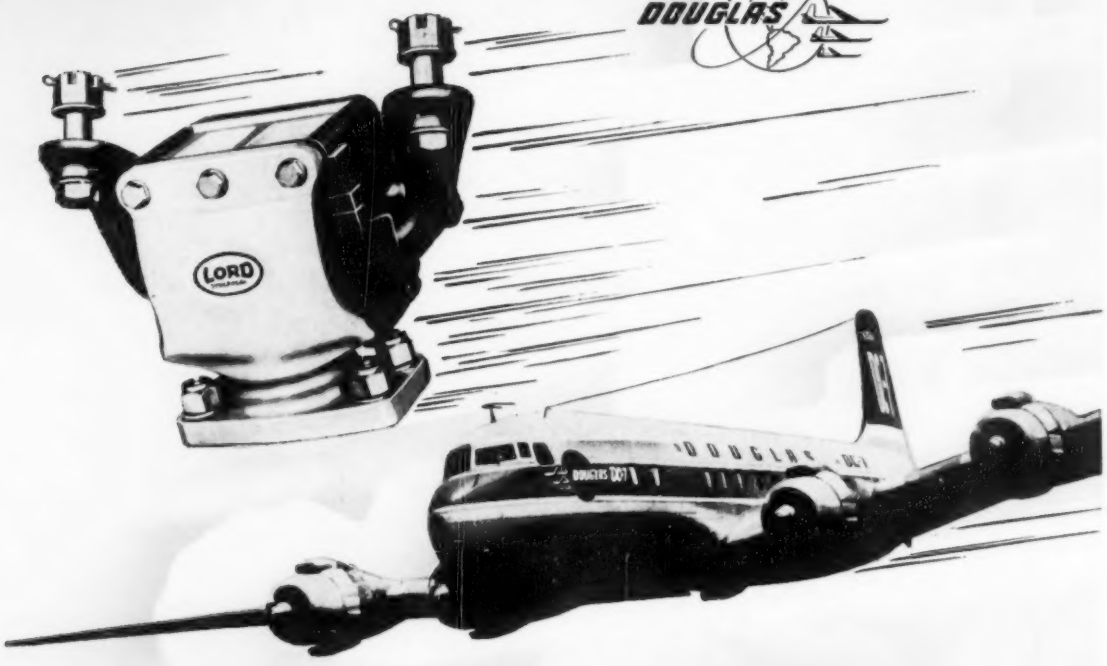

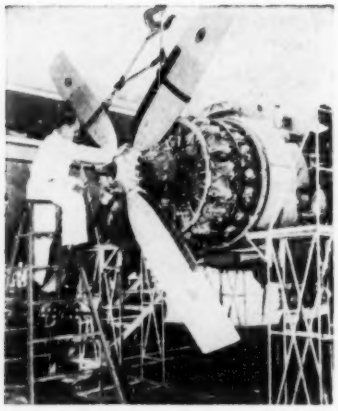

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THEY MADE A LADY OUT OF THE F-89. That's one of the successes achieved by Northrop Aircraft's revamped technical team.

How Should Engineer Staff Be Organized?

Northrop Banks on Combination Setup

• Management aims for strength of a project-type approach plus versatility inherent in group system.

By David A. Anderton

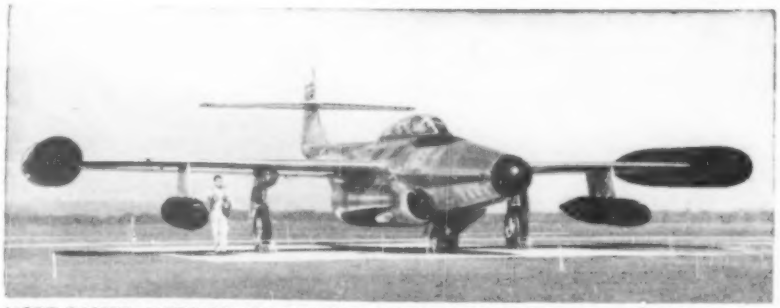
Hawthorne, Calif.—A different concept in engineering organization is sparking Northrop Aircraft, Inc.'s drive to gain new markets for its wide variety of aircraft and associated ideas.

Reorganized about two years ago, the Northrop engineering staff—now numbering about 3,000—combines the strength of a project-type organization with the versatility found in a group system.

With many specialists in the newer technologies of fire control and weapons systems added to a group with long experience in many types of aircraft designs, the Northrop engineering management feels capable of tackling any aircraft problem requiring a solution that flies or shoots.

▶ **Project List**—Northrop engineers work on a large number of projects, from small unguided rockets through large longrange missiles to heavy and complex all-weather interceptors. They work in avionics, optics, guidance and ordnance.

They have revitalized and strengthened the aging F-89 Scorpion to the point where her accident record is one of the best in the USAF, and her performance at altitude almost unbeatable.



MORE RANGE, MORE PUNCH COMING—F-89D is not the limit, says Northrop.

They have developed the XB-62 Snark, longrange pilotless bomber for the Air Force, and can claim "encouraging progress" for the missile, an accolade in a field where progress is all too slow.

Coming up, say reports, are a new lightweight fighter, more stretch in the F-89, a new heavyweight longrange interceptor and an advanced version of the Snark.

▶ **Leadership**—In charge of engineering at the vice-presidential level is Edgar Schmued, whose previous experience included spearheading the design of the Mustang and Sabre while at North American Aviation, Inc.

Under Schmued is chief engineer Dr. William F. Ballhaus, with preliminary design experience at Convair and Douglas-El Segundo under his belt.

Schmued and Ballhaus told AVIATION WEEK some of their ideas on the way to organize and manage an engineering department.

"Our goal is a high-priced, low-cost department," said Ballhaus. "We want to attract good talent, work them hard and pay them well. We can get more useful work out of two good high-priced men than out of three or four lower-salaried, inferior engineers."

"That would give us the smallest engineering department to do the job," added Schmued. "Then we must develop the most efficient organization to use those men."

Schmued and Ballhaus visualize a department organization combining the merits of the so-called "vertical" or

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Engineering data 70A sent on request

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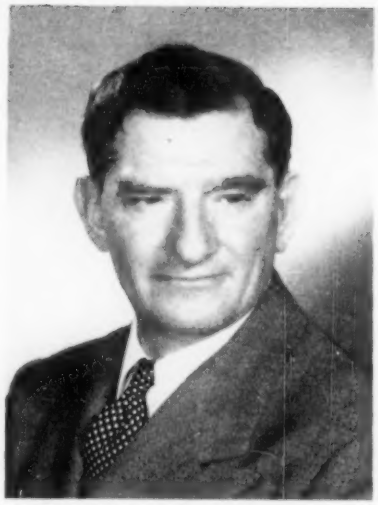


RUNNING THE SHOW—Edgar Schmued (left), vice president in charge of engineering, and Dr. William F. Ballhaus, chief engineer, run Northrop's reorganized engineering team.

project type, and the "horizontal" or group type.

▶ **Explanation**—In typical project organizations, there is a project engineer as overall coordinator. Under him in line are representatives of aerodynamics, structures, avionics, mechanical design and other groups. Each of his subordinates works on the specific project only.

In contrast, the group organization divides the working force into aerodynamics, structures, avionics and other working teams, and feeds all project work into those groups. A man in a group organization may work at one type of work, such as flutter analysis, but he will do it for all the projects.

Schmued would like to combine the two ideas, even in the layout of his new engineering building. There won't be any formal grouping of design or project teams in remote offices.

In effect, says Schmued, ". . . we will put everybody into one large room. If I want to check the state of the art in general design, I walk across the rows. If I want to determine the status of a particular project, I walk up and down the rows of desks and tables."

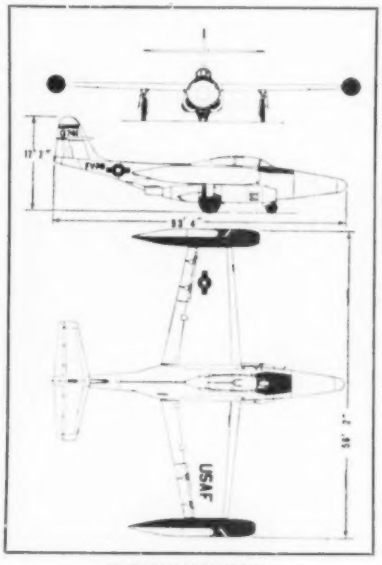
▶ **What to Do**—"We only want to work on projects that have a direct bearing on products," said Schmued. "We believe that pure research contracts belong in universities."

"We are experience-heavy in people who know fire control and weapons, including things that shoot," Schmued added. "For example, we are doing many specific studies of weapons systems in small areas with great detail. This complements the work done by people like the Rand Corp., who make general studies in large areas with little detail."

"We think we have the best people for weapons systems," said Ballhaus. "Northrop has done a lot of work on specific designs of fighters and interceptors. We do this to find out the needs of the Air Force, and to help us design weapons to fit those needs."

▶ **Missile Work**—One of those needs is the longrange Snark. Nine years of labor on this pilotless bomber are beginning to pay off in test flights at the Air Force Missile Test Center, Cocoa, Fla., where the big birds have been carrying out operations for many months.

Another apparent AF need is a long-range interceptor; not a local defense plane, but something with enough range to clobber the enemy before he gets near the defense perimeter. To-



F-89D SCORPION

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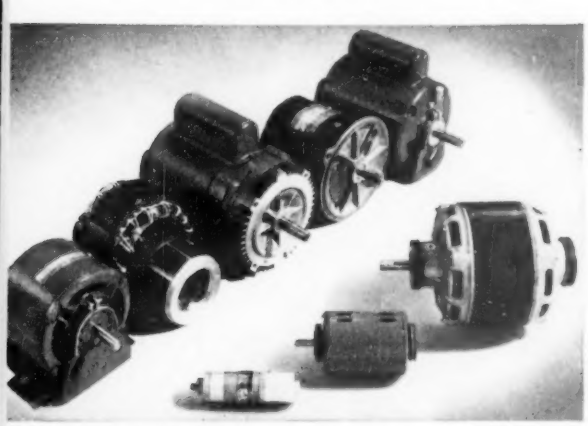

LEADING DESIGNS—Today's G-E fhp motors—climaxing 52 years of leadership—are industry's most advanced; feature modern materials, compact size, superior performance.

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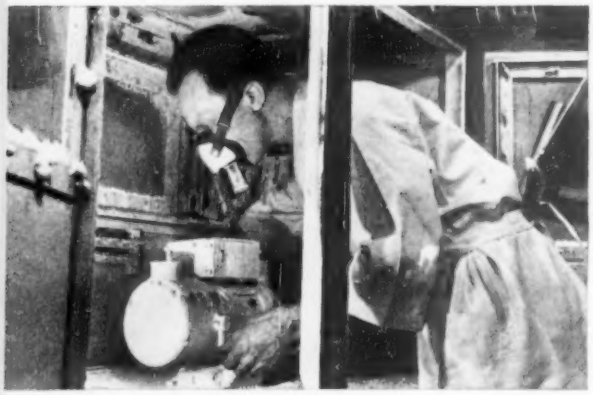

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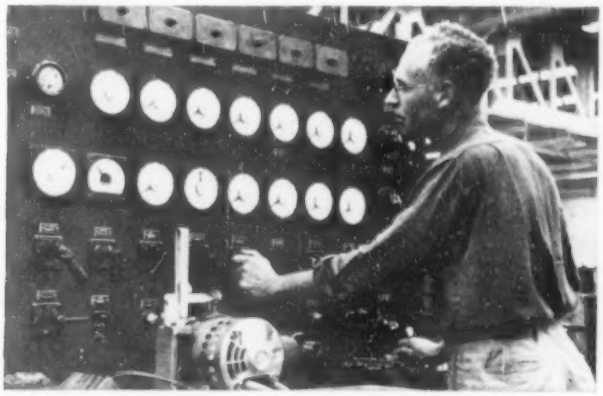

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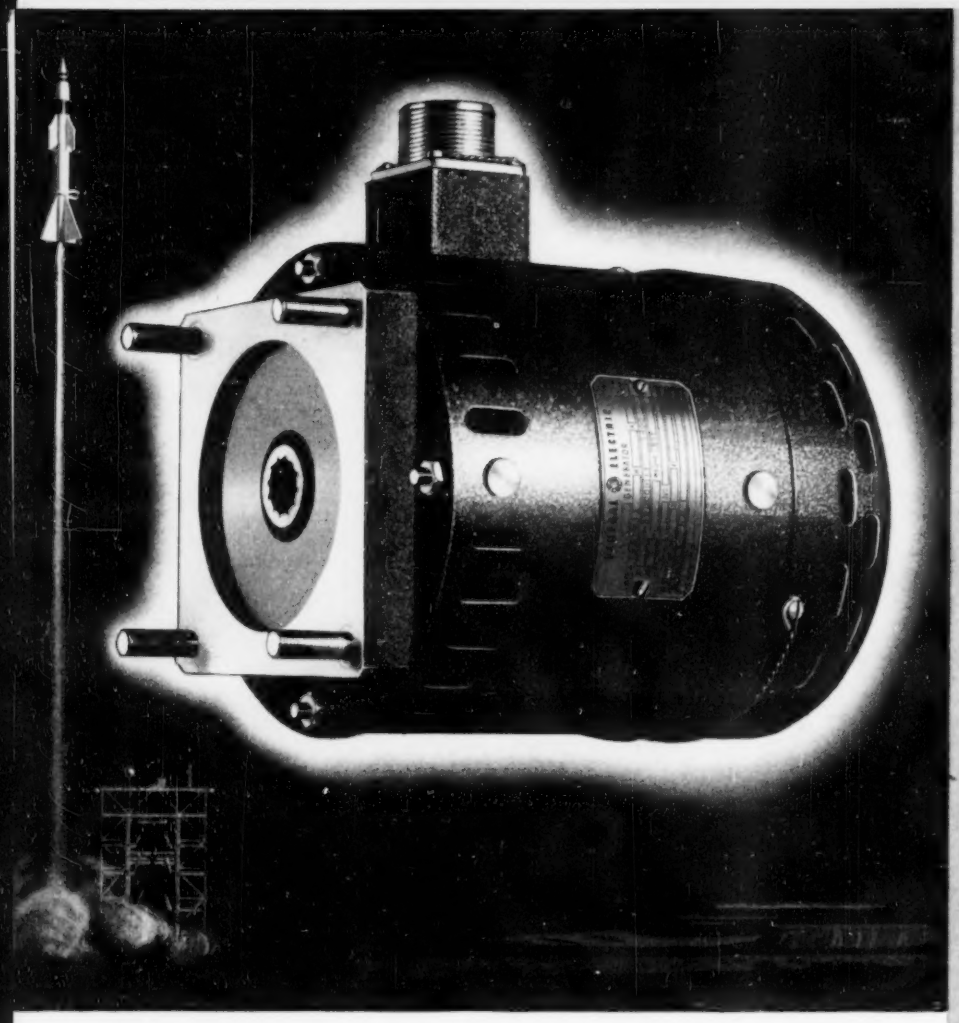
FOR MORE REASONS WHY G.E. IS YOUR BEST SOURCE OF FHP MOTORS, TURN PAGE ▶



G.E. designs 400-cycle alternator to meet demanding guided-missile requirements

Another example of G-E motors for aircraft

NEWLY DEVELOPED to withstand the tremendous range of shock, temperature and atmospheric conditions encountered in guided-missile applications, this explosion-resistant 400-cycle alternator meets rigid environmental and military specifications (MIL-E-5272, procedure 1). Rated up to 1500 volt-amperes, 12,000 rpm, for output of 115 volts, this unit is designed to be driven by a wide variety of d-c, a-c, turbine, and jet-air drives.

RIGID TESTING assures that this alternator—and all G-E aircraft and armament motors—meet specifications regarding altitude, shock, temperature, vibration, humidity, sand and dust, and centrifugal force.

YOUR SPECIFICATIONS are all that G-E motor engineers need to begin applying their years of experience to your aircraft and armament problems. Contact your G-E Apparatus Sales Office today. Or write: General Electric Co., Section 704-29, Schenectady 5, New York.

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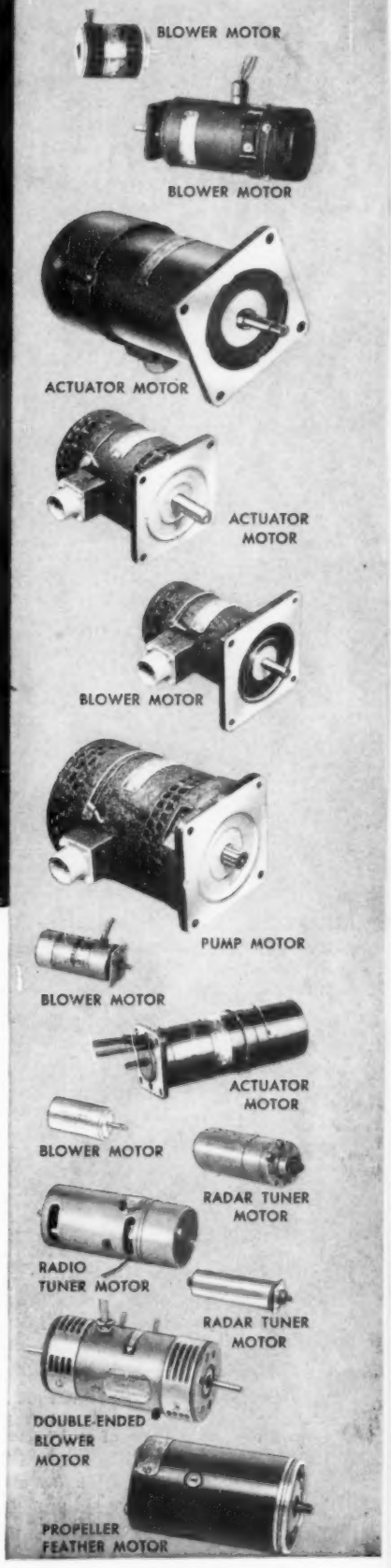


A few of the hundreds of aircraft and armament motors designed and built by General Electric.

Why JET ENGINES need Heat-Resistant Alloy Castings

Take a look at these castings...

In each one, specific advantages are gained by casting the part in heat and corrosion-resistant alloy containing nickel.

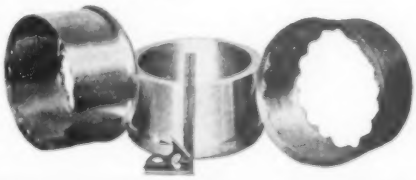
Nickel-containing alloys are also specified for combustion chambers, nozzle vanes, flame tube casings, and other components subject to heavy stresses, intense heat, corrosion fatigue and other service conditions.

High alloy castings containing nickel may be of help to you on jobs where resistance to heat and corrosion are prime requisites. Send us details of your problems for our suggestions. Write today.

INCO

JET ENGINE DIFFUSER CONE... produced by SOLAR AIRCRAFT COMPANY, San Diego, Calif., for use in J34 jet engines. Made from 18-8 columbium-stabilized stainless steel (AMS 5363) this casting replaced forgings, and resulted in greater economy plus superior dimensional stability of the part after machining. Diameter: 24 in.—Weight: 200 lbs

NOZZLE DIAPHRAGM . . . used in aircraft engines at temperatures up to 1600°F. Produced by LEBANON STEEL FOUNDRY, Lebanon, Pa., this part is cast in chromium-nickel stainless steel (CF-8C alloy, approximately equivalent to Type 347 wrought material).



JET ENGINE RINGS . . . centrifugally cast by the DURALOY COMPANY, Scottdale, Pa., using 25% chromium—14% nickel—3% tungsten alloy. The center casting is a rough machined blank. The end castings are finished rings. These parts are used at temperatures of 600°-700°F., under highly oxidizing conditions. Diameter: about 15 in

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day that job is being done by the much-maligned F-89 Scorpion.

"What did you do to make the F-89 a lady?" AVIATION WEEK asked Schmued, who came right back with, "She's not a lady; she's a workhorse." His comment started a whole string of praises for the Scorpion.

"The F-89 is the only plane in the inventory that will do the longrange interception problem, even though she's 10 years old. . . . She's slow to get away, but after you get above 10 or 20,000 ft., she'll outclimb the others. . . . I heard she took on an F-86 and F-94C and beat them both to 40,000 ft. . . . We're spending money now to get some more stretch out of her. She is not at her aerodynamic ceiling yet, so it's pretty obvious that we've got to add some power and we'll pick up altitude and some knots at best maneuvering speed."

▶ **F-89 Redesign**—Ballhaus said the test flying program on the Scorpion after its groundings was one of the few cases where such extensive work had been done. Northrop engineers instrumented a Scorpion, flew it for hours getting the flight loads in all conditions of flight. This data was fed back into the redesign of the basic structure.

"There was a complete revision of structural qualities to meet flight loads," added Schmued.

That redesign and the subsequent modification took a year and a half, and was done with no fee to Northrop. But it has paid off in many ways: Pilots love the airplane, she can do the job, and there's stretch to grow on.

▶ **Where To?**—Northrop, like other firms with experienced engineering teams, is looking ahead to projects that will test the skill of its designers.

"The technical competence of our engineering staff is equal to anybody's," said Ballhaus. "Just to show you: We had a new project and the Air Force wanted it in one hell of a hurry. We thought we could do the job in one year, but everybody told us we were crazy. We talked to the Air Force and convinced them that they ought to let us try.

"They had faith and they gave us pretty much of a free hand. We did the job within the year we had set."

Northrop is looking into transport areas, too, not wanting to miss any bets. John Alison, vice president for administration, told AVIATION WEEK that the company was studying the executive transport, but only as a matter of routine investigation of the possible market. "If you don't keep looking around," said Alison, "you can lose business. Don't expect us to start building transports tomorrow, though."

▶ **Transport Study**—Another Northrop executive, T. V. Jones, deputy chief engineer, presented a condensation of a detailed study in air logistics at the recent SAE national aeronautic meeting in Los Angeles. Jones worked on the study with members of the Rand Corp., with whom he was associated before joining Northrop.

The study was to help determine the type of military transport to be developed to meet future logistic requirements. It covers an extreme range of designs, types which are assumed to be operational in eight to 10 years if the necessary development were carried out from the present.

Design payloads vary from 25,000 lb. to 150,000 lb.; ranges are from 1,500 to 3,500 nautical miles. Field lengths were assumed from 2,000 to 6,000 ft., and cruising speeds between 180 and 490 knots were considered. Compound-reciprocating, turboprop and turbojet engines were used.

▶ **Dream House**—Recently the company has announced that Pereira and Luckman, top architectural and engineering firm, is to prepare a master plan for extension of the Northrop facilities. Included: One of the nation's most advanced engineering and research centers.

In this engineers' dream house, the Northrop teams will turn their visions into tangible hardware.

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MULTIDIRECTIONAL SHOULDER HARNESS TAKE-UP

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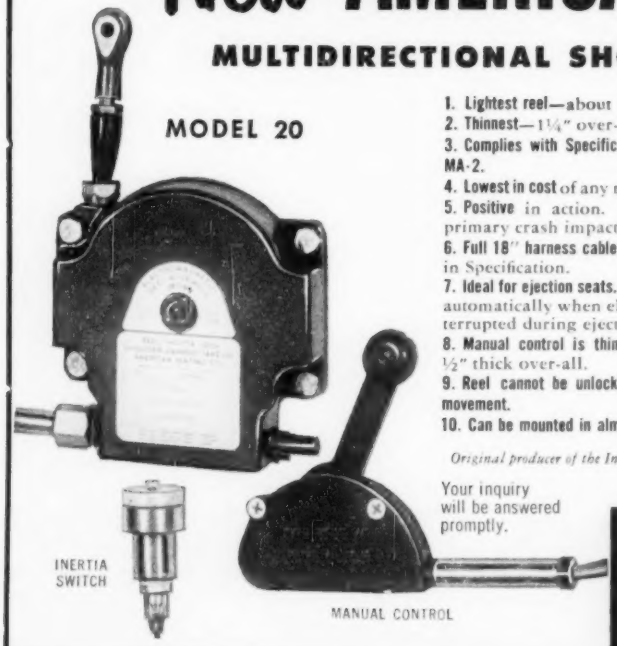

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3. **Complies with Specification MIL-R-8236 Type MA-2.**
4. **Lowest in cost** of any multidirectional reel.
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10. **Can be mounted in almost any position,** as inertia locking action is controlled by a new inertia switch, mounted independently of reel. The light weight switch will operate several reels.
11. **Reel can be disassembled** and overhauled by user without returning to factory for recalibration. Only the trouble-free inertia switch is factory-sealed.
12. **Design incorporates suggestions** of aircraft manufacturers. Aircraft engineers available for consultation.
13. Uses same mounting hole spaces as other reels of our manufacture.
14. Mock-up units available for your development work.

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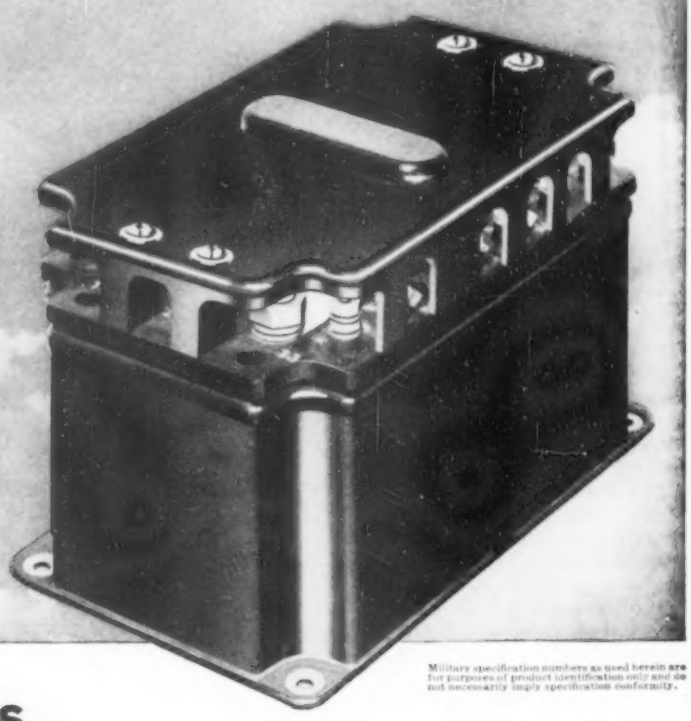

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Latch employs "over-center" principle with roller bearing as latching surface. This design reduces energy necessary to trip latch and insures that breaker remains latched in extreme shock conditions.

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Main contacts are connected directly to plunger of closing solenoid. No levers or highly loaded bearings are required for contact actuation. Wear is eliminated through absence of both fulcrums and plastic contact-actuation points. The contact's long operating stroke eliminates frequent adjustment for accuracy.

3. Positive Anti-Pump Circuit
Interlock relay provides positive anti-pump circuit. Adjustment of interlock contacts is noncritical.

4. Easier Contact Inspection
Special construction allows inspection of main contacts without disassembly of breaker.

Jack & Heintz engineering personnel and manufacturing facilities are geared to undertake design and production of complete a-c systems or individual components. We invite your inquiry. Write Jack & Heintz, Inc., 17635 Broadway, Cleveland 1, Ohio.

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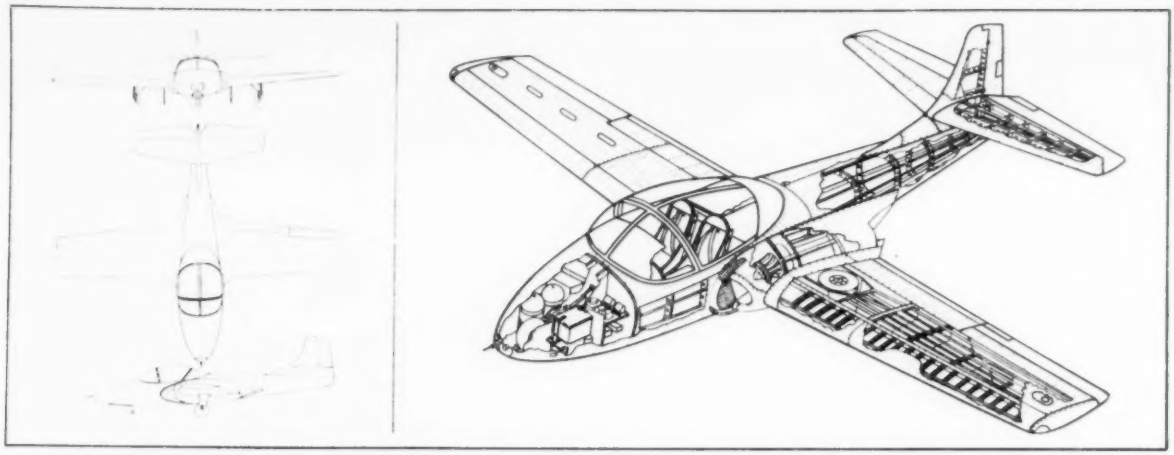
JACK & HEINTZ *Rotomotive* AIRCRAFT EQUIPMENT



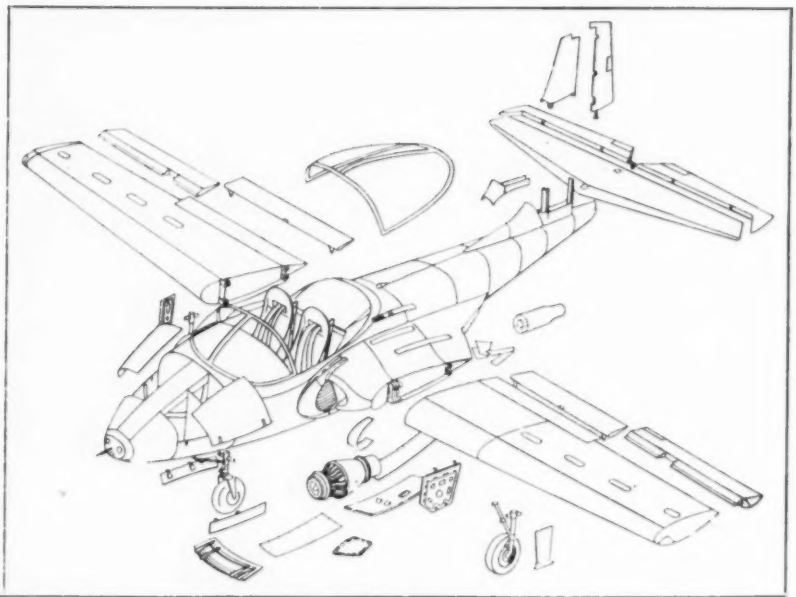
Details of Cessna XT-37 Twin-Jet Trainer

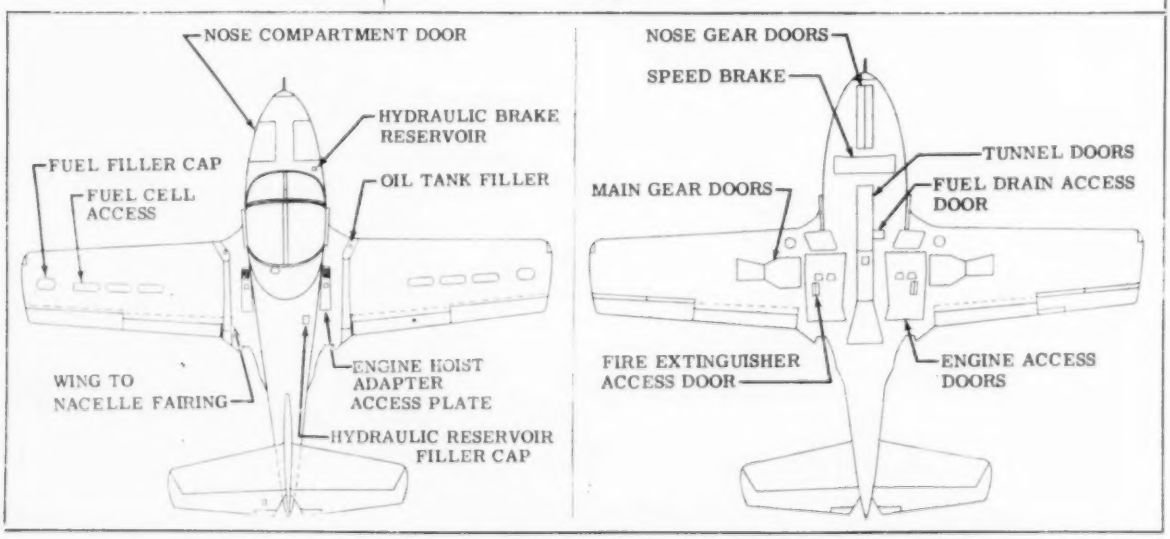
New Cessna twin-jet intermediate trainer, the XT-37, is shown here in various aspects, revealing its general makeup. Incorporating side-by-side seats, it is the first Air Force trainer of its type. The XT-37 first flew Oct. 12 (Aviation Week Oct. 18, p. 15).

Plane is powered by two 920-lb.-thrust Continental XJ69-T-15 engines. Flush steps on each side of cockpit eliminate the need for stands or ladders when entering or leaving the aircraft.

All access doors for servicing and maintenance are accessible from the ground. A large access door at bottom of each nacelle is installed for engine inspection and removal. Bottom fuselage tunnel doors give access to control systems and hydraulic equipment for inspection and maintenance.

Access to battery, radio, inverters, voltage regulators, and oxygen bottles is easy through large doors on each side of the nose.





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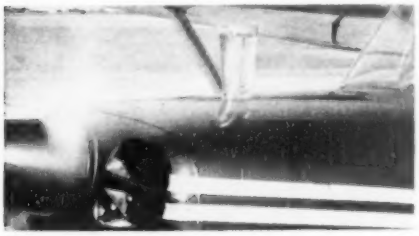
1▶ Smooth 6-Cylinder Power

Cessna is the only airplane in the low-price field that offers you a powerful 6-cylinder, 145 H. P. engine! It cruises over 120 m.p.h. yet it's so smooth, quiet, vibration-free that when the engine is running you can rest a glass of water on the cowling without disturbing the contents!



2▶ The Landing Gear that "Gives"

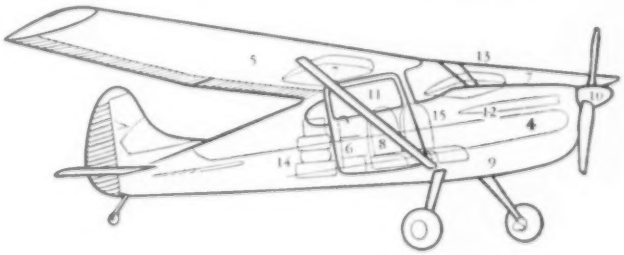
Cessna's exclusive landing gear flexes outward and upward to absorb the shock of rough fields. It's simple in design, has no moving parts, requires no maintenance!

3▶ Compact Control Panel

All controls are grouped within handy 6" reach of the pilot's hand. There's a new sloping map compartment, room for 2 extra radios, 8 additional instruments. Attractive non-glare instrument panel is evenly illuminated by dual non-reflecting lights.

Cessna 170 Extras—All Standard!

. . . Undisputed Proof That Cessna 170 Is Your Best Buy In The Low-Price Field!



4▶ 145 H. P. CONTINENTAL ENGINE
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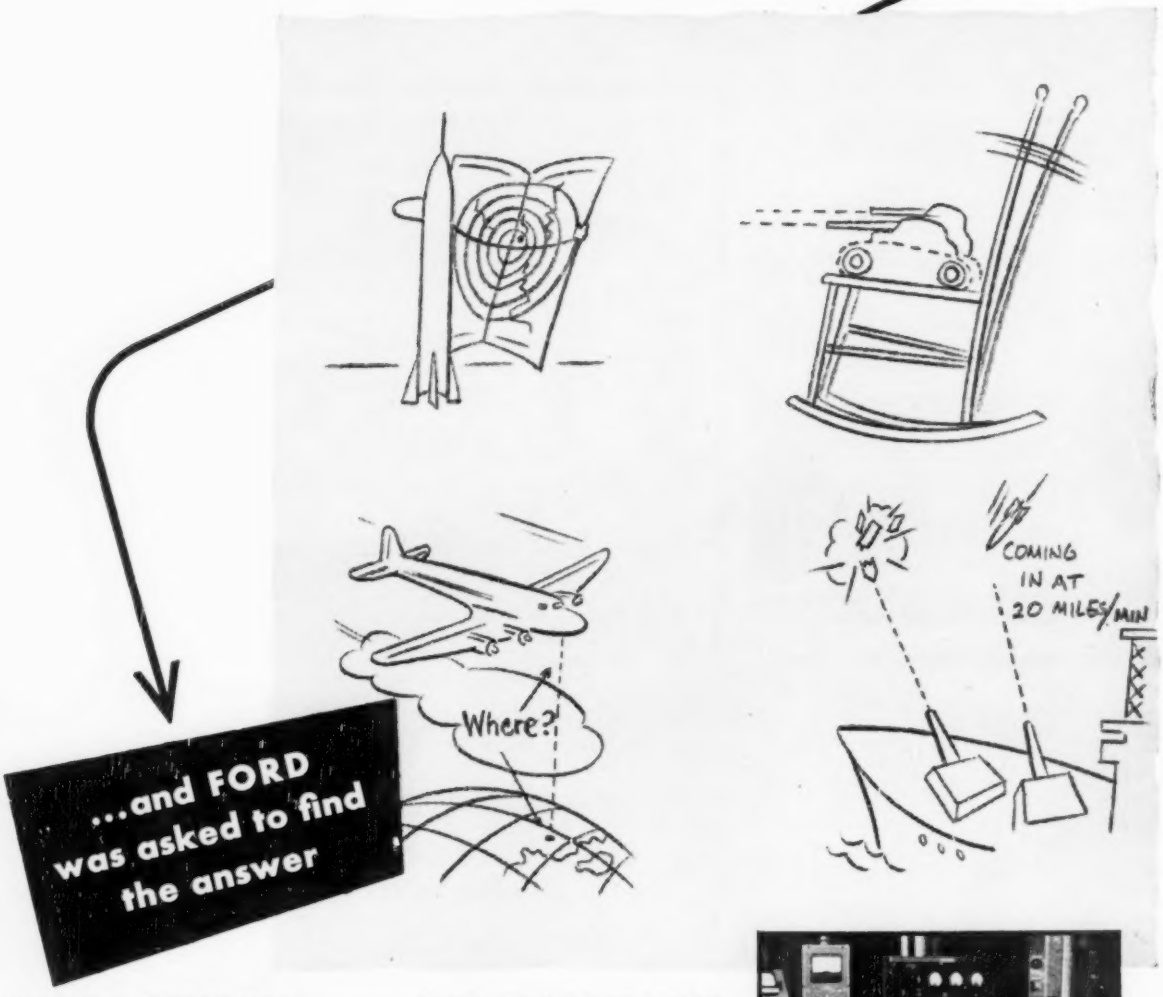
HOW CAN AUTOMATIC CONTROL
strengthen our defenses



MISSILE GUIDANCE . . . GUN STABILIZATION
AIRCRAFT NAVIGATION . . . WEAPONS SYSTEMS

The staff of engineers at Ford Instrument Company are experts in the field of automatic control. Every week, in the laboratories and shops of this large company thousands of men are working on electronic, hydraulic, mechanical and electrical servo-mechanisms, computers, controls and drives to solve problems for the Army, Navy and Air Force. Ever since Hannibal C. Ford started, in 1915, to develop and build the first gunfire computer for the U.S. Navy, Ford Instrument has been leading the way in applying the science of automatic control to America's defensive strength . . . and to American industry.

34

Each year the Ford Instrument Company is adding to its staff of several hundred engineers. If you are an engineer and can qualify, there may be a position for you.

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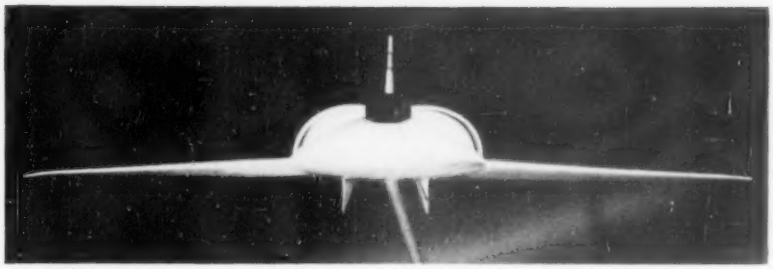
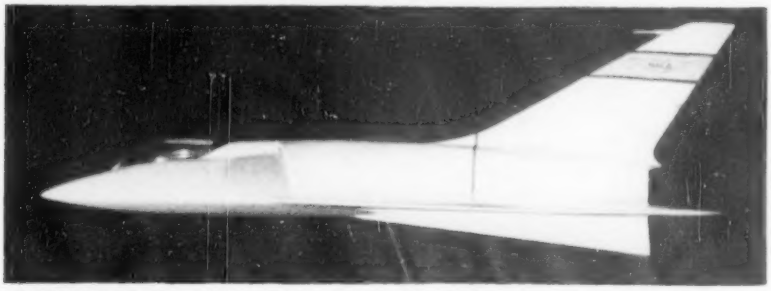
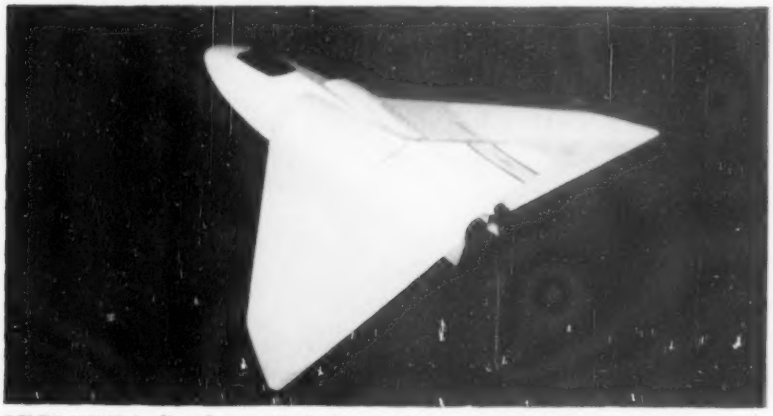


FLAT-BOTTOM fuselage contributes lift as Mach number and attack angle increase.



VENTRAL FINS give stability and control at high attack angles (such as in landing).



DELTA WING is clipped to avoid planform with too much flexibility at the tips.

NACA Shows Lift-Fuselage Model

An unusual study configuration with possible application to a future supersonic interceptor was exhibited recently by the National Advisory Committee for Aeronautics at the opening of San Francisco's new airport.

NACA was careful to specify that the plane was not an actual aircraft design, but merely typical of many tested features. "The model was an eye-catcher, nothing more," said a spokesman for the research agency.

▶ **Yes and No**—Eyecatcher or not, the model is an intriguing layout. Basic feature is a lifting fuselage, a design idea that has received much attention lately. Aerodynamic calculations show that a flat-bottomed fuselage can supply large portions of total aircraft lift as Mach number and angle of attack increase.

In extreme cases, designs completely without wings appear possible, and external surfaces would supply only stability and control.

Engine air intakes do not differ much from current practice; they have long, flat ramps leading into the inlet, and boundary-layer bleeds inside the opening. Such a configuration would appear to be equally adaptable to a ramjet or a supersonic turbojet.

▶ **Wing and Tail**—The basic delta geometry of the wing has been modified for structural reasons, not for aerodynamic. Original lines, if extended to the theoretical tip, might have given a planform with too much flexibility at the tips.

Ventral fins are for stability and control at high angles of attack (typified by landing, for example); in this attitude, the downwash from the forward part of the fuselage reduces the effectiveness of the vertical tail. The reason the fins are angled outward slightly is to reduce the length of landing gear required for runway clearance.

Through continued study and tests of typical models like the one shown here, NACA scientists keep in step with design thinking in industry.

THRUST & DRAG

One of these days, a smart engineering school is going to start a curriculum leading to the degree of Investigating Engineer. Graduates of this course will be able to make a good career serving on committees appointed to investigate the guided missile program.

The recent announcement of the formation of the Newbury committee heralds another sweeping review of the missile mish-mash. Like others before it, the committee—good and able men and their assistants—will labor hard and long and write a report.

It will take six months to write the report and another six months for its review. By then, its recommendations will be hopelessly out of date—or at least, this will be the claim of the contractors whose missiles were decried—and there will have to be another committee. This can go on until we run out of time, and then we won't really need any more investigations.

* * *

Most frustrating military job nowadays must belong to the officers charged with placing Nike batteries around the countryside. Some time back, congressmen were beating on these officers to hurry and do something about defending Bicep Gulch or East Backwash with the new wonder weapons.

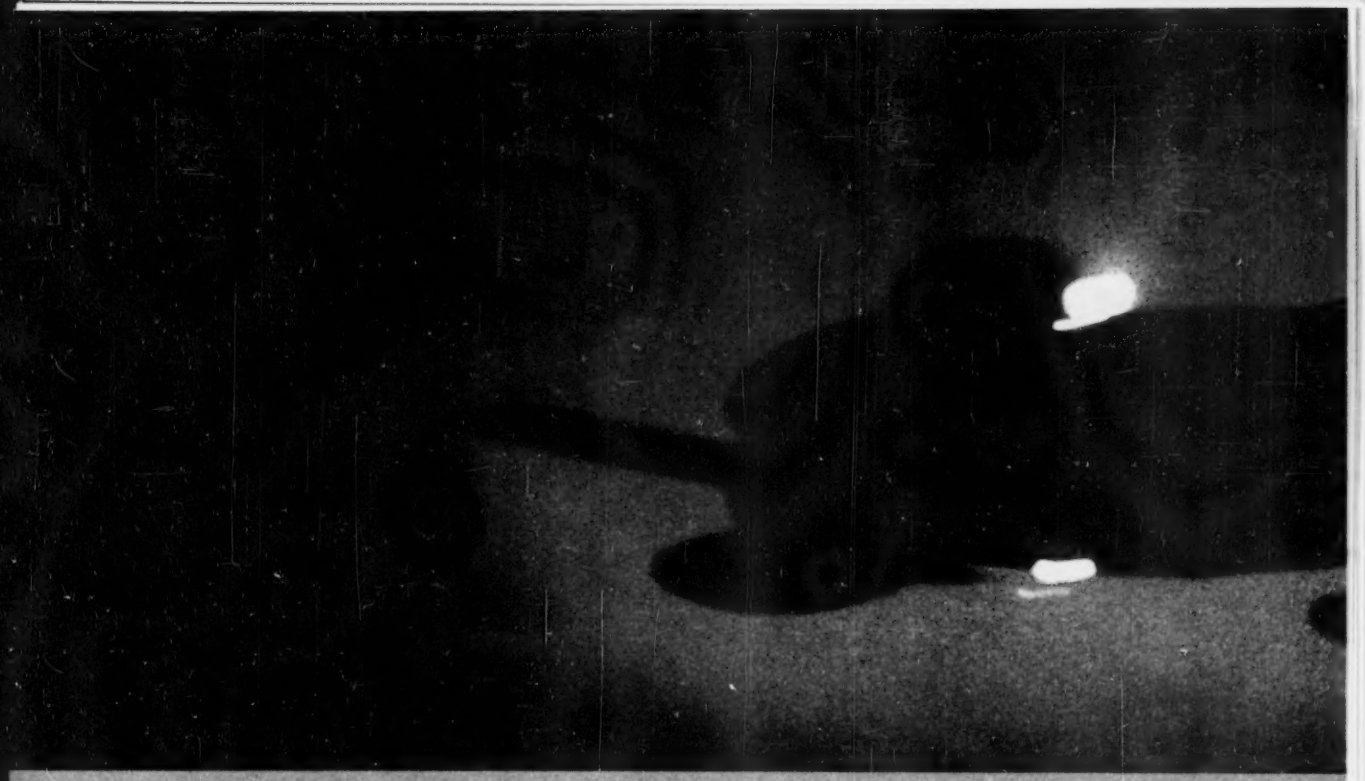
So the military, ever responsive to the demands of the citizenry, busted guts trying to get batteries sited here and there. Now what?

The same congressmen are back, beating on the same officers, to hurry and do something about getting the new wonder weapons out of Bicep Gulch and East Backwash where they are ruining property values and the scenery and the quiet evenings and the farmers' daughters.

* * *

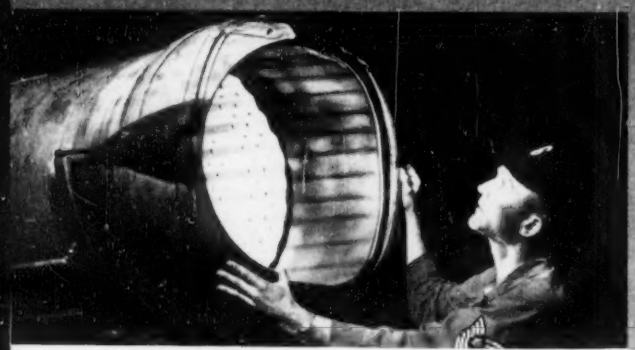
Lockheed's proposals, models, specs and associated material for the current USAF tanker competition weighed in at 1,185 lb. exclusive of crates before its recent shipment to the Air Force. I can remember when a proposal consisted of a 10-page report and a single study model.

[Voice from the back of the room: "I can remember when a whole airplane weighed less than 1,185 lb."] —DAA

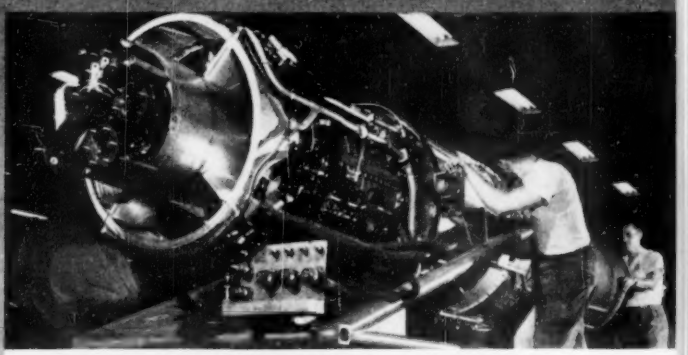


NEW INLET GUIDE VANES allow more air to enter compressor of J47-GE-33 engine. New vanes have same configuration as those used on J47-GE-17, but pay off in increased thrust during dry and afterburner operation.

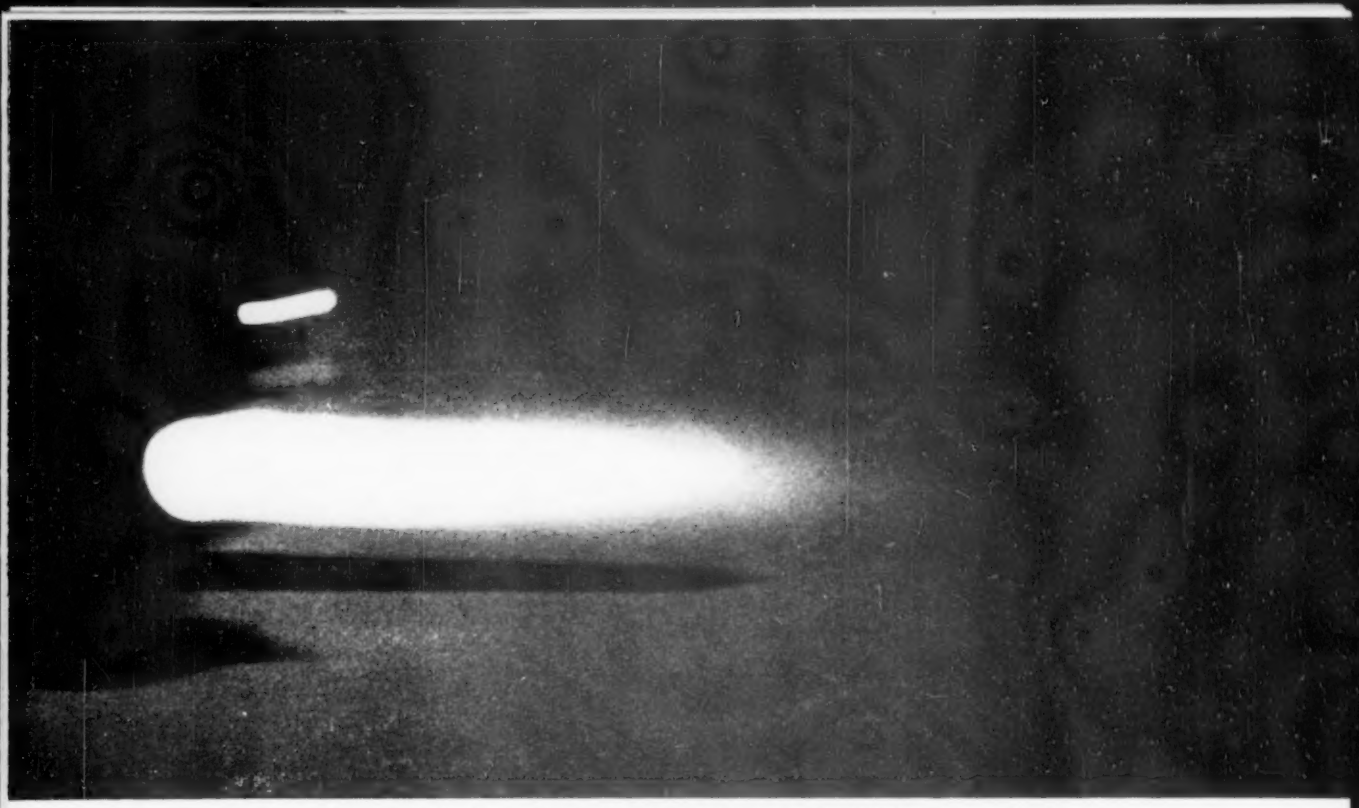
IMPROVED RELIABILITY in the J47-GE-33 engine is illustrated by the new "floating" shim shroud visible above. It reduces the possibility of shroud ring rub on turbine wheel buckets. G-E tech rep is pointing to new adjustable turbine baffle.



NEW, LARGER "EYELID" handles increased J47-GE-33 airflow. Just inside 'lid, a sturdy ceramic-coated liner acts as a radiation shield, allows higher afterburner fuel flow; also preserves boundary layer cooling of the tailpipe.



CAREFUL J47-GE-33 QUALITY CONTROL at G-E manufacturing plants is already paying dividends to the Air Force. For example, only one-out-of-four J47-GE-33's now require two tests before shipment to the USAF.



More "D" Sabre Jets are in use today than all other types of USAF interceptors combined.

Why the F-86D Sabre Jet Interceptor Now Climbs UPSTAIRS....20% FASTER!

New production model J47-GE-33 jet engine packs more thrust, also improves "D" reliability and ease-of-maintenance

For the past three years, North American Aviation's F-86D Sabre Jet has been the fastest interceptor in the Air Force's Air Defense Command (top speed: over 650 mph).

Today a new General Electric turbojet, the J47-GE-33, is being installed in "D" Sabres. The engine makes the "D" still faster . . . more reliable . . . easier to maintain.

The J47-GE-33 has the same basic design as its predecessor, the J47-GE-17. But these six improvements reduce its weight, increase its durability, and, most important, allow it to swallow more air and increase its afterburner power:

1. New inlet guide vanes
2. New capacitor discharge engine ignition system
3. New "floating" turbine wheel shim shroud
4. New Hotstreak afterburner ignition system
5. New ceramic inner-liner for afterburner
6. New larger variable area jet nozzle

The J47-GE-33 can peel 20% off the time originally required to "scramble" an F-86D from standing start to 45,000 feet.

By helping the Air Force reduce maintenance time and costs, as well as increase jet performance, the J47-GE-33 again illustrates the G-E slogan, "Progress is our most important product." *Section 232-3, General Electric Co., Schenectady 5, N. Y.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

PRODUCTION BRIEFING

► **Harvey Aluminum,** Torrance, Calif., announces a major expansion of forging facilities, including an 8,000-ton forging press and two 4,000-ton units. Completion date of the housing structures is targeted for early next year. The buildings also will accommodate secondary forging operations such as trimming, heat treating, etc. Production on the new presses is scheduled for middle of next year. The 8,000-ton unit will have an available forging area of 40 sq. ft.

► **North American Aviation, Inc.** is putting up a new 174,000-sq. ft. manufacturing facility at its main plant, Los Angeles International Airport. Structure will cost about $1.2 million and will handle F-100 Super Sabre production as well as work on newer planes. It is expected to be in operation next February.

► **Sprague Engineering Corp.** is new name of former Sprague Engineering & Sales Corp., Gardena, Calif., maker of aircraft and industrial test equipment.

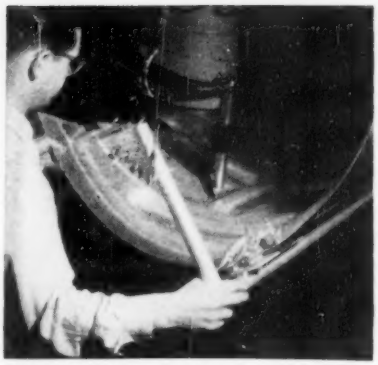
► **Aero Supply Manufacturing Co., Inc.,** Corry, Pa., has entered into an agreement with V. W. Eckel, Northridge, Calif., to make and sell on a national basis, a novel solenoid-operated shutoff valve said to be about one-half the size and weight of most conventional units. More than 100 variations of the valve have been developed ranging up to ¾-in. tube size, capable of handling all aircraft fluids at pressures up to 3,000 psi. or more.

► **Krouse Western Laboratories, Inc.** has been formed to handle specialized fatigue tests of materials and repeated loading of parts and components. Firm, located at 6048 Hazeltine Ave., Van Nuys, Calif., is headed by Glen Krouse, well-known for his original design and building of equipment in this field.

► **Engine Works, Inc.,** has moved into new facilities for business aircraft overhaul just off Lambert Field, St. Louis. New shop has over 8,000 sq. ft. of floor space and is being fitted with much new and specialized equipment.

► **A. O. Smith Corp.** has formed a Pacific Coast Works at Los Angeles to be a new manufacturing and service section devoted exclusively to aviation products. General manager is F. A. Henry. A. O. Smith handles some aircraft components production at its Milwaukee main plant and several East Coast factories and its Rochester, N. Y., factory is devoted entirely to aircraft work.

► **A new welding process,** said to be 15%-20% faster and 25%-50% more economical than other manual and semi-automatic inert-gas methods has been developed by Westinghouse Electric Corp., Arc Welding Dept., Buffalo, N. Y. Now in production, the new technique involves use of a new coated wire—West-ing-arc MS-20.



WELDING AID developed at Glenn L. Martin Co. enables one man to handle unwieldy multi-contour aircraft assemblies—some of which took two or three men to hold during previous method of operation. Small parts are hung from an overhead crane, large parts are mounted at their CG on an arm built out from the base of the machine.

► **Northrop Aircraft, Inc.,** Hawthorne, Calif., reports that $2,353,000 has been saved as a result of about 14,600 suggestions submitted by employes since 1946, with approximately $580,000 saved by 673 suggestions during the fiscal year ended July 31. Awards for suggestions ranged from $1,000 to $10, with four of the former having been granted.

► **Tough saw blades made** of Kennametal (Kennametal, Inc., Pittsburgh) have cut more than 120 mi. of aluminum alloy without appreciable wear to the blades at Fletcher Aviation Corp.'s Pasadena, Calif., plant. The eight-inch saws, powered by two 3-hp. motors, turn at 3,000 rpm. with a 25-fpm. feed making precision cuts in drop tanks. The saws were devised by Fred Dillon of Fletcher. Previously, four men using hand-operated routers could make only 150 cuts daily. Kennametal is a powder metallurgy product using tungsten and titanium carbides and cobalt for toughness.

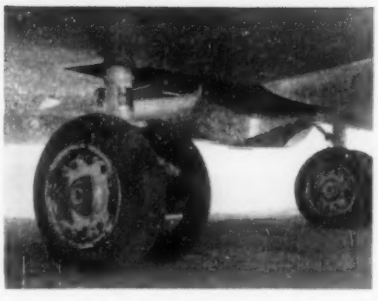
► **Armoloy Co.** has been formed in Fort Worth, Tex., to exploit advantages of a multi-stage electrode position process stated to armor-plate metal surfaces for longer wear. Firm has acquired a 12,600-sq. ft. plant.

► **Stratoflex, Inc.,** maker of detachable hose fittings and flexible hose assemblies, has opened a 10,000-sq.-ft. plant at 9430 Bellanca Ave., Los Angeles, to serve: West Coast, Alaska and Hawaii.

► **Aircraft Division** of Ledcote Products Co. of New York, Inc., has completed a new 15,000-sq. ft. Kirksite foundry and installed three new Cecostamps, giving the firm a total of 20 drop hammers.

Diabolo Dassault

New double-wheeled landing gear—called "diabolo" gear by the French—is featured on this modified Avions Marcel Dassault Ouragan, standard jet fighter with the French Air Force. Adaption of the design was to meet NATO command interest in tactical-support airplane which can take off and land on short, grass strips. Dassault says plane can take off in about 1,300 ft., land in less than 1,000 ft. Plane is equipped with a tail drogue parachute for short landings. Tests have been made of the modified Ouragan at the Bretigny flight test center. The manufacturer says the 350 Ouragans in service with the French Air Force could be adapted for the diabolo gear.



Diode-Amplifier Is New Threat to Tubes

A new type amplifier which uses two-element semi-conductors (diodes) holds promise of eliminating many of the vacuum tubes now used in airborne and ground-based digital computers, cutting their size and weight. It was developed at the National Bureau of Standards.

Oddly, the new diode amplifier owes its operation to a characteristic of semi-conductors which has heretofore been considered undesirable—the reverse transient phenomenon. The new technique can be applied to decade counters, pulse repeater stages, various types of flip-flop circuits, or used as a wide-band, flat-response amplifier. Power gains up to 10 per stage have been obtained.

The new diode amplifier was developed by A. W. Holt, chief of NBS's components and digital techniques section, data processing systems division.

▶ **High-Frequency Operation Too**—Using the newer silicon diodes, a current-doubler-type flip-flop has been operated at clock frequencies as high as 25 mc. With anticipated future improvements in diode response time, the new amplifier may be able to operate at microwave frequencies, NBS says.

One basic requirement for the new diode amplifier is that it must be supplied with power from an RF source whose frequency equals or exceeds that of the modulating (input) signal. In this respect, the diode amplifier resembles magnetic and dielectric amplifiers.

▶ **Principles of Operation**—To understand the diode amplifier, it is necessary to recognize the two static states in which a germanium or silicon diode can be placed:

- **Forward conducting,** characterized by high conductivity, is created by applying a biasing voltage so that the diode's anode becomes more positive than its cathode.
- **Reverse conducting,** characterized by low conductivity, is achieved by applying voltage of a reverse polarity.

The forward voltage acts to create a steady supply of "current carriers" within the semi-conductor material, thus maintaining a condition of high conductivity. During reverse polarity biasing, current carriers are not created.

▶ **Transient Phenomenon**—If the voltage applied to a diode is switched quickly from forward to reverse voltage, a transient phenomenon occurs in which a large reverse current flows for a brief interval, decaying until the static reverse state is reached. This transient current occurs because the carriers which were present due to the previous forward voltage, remain available to be swept out in the reverse direction when the opposite-polarity voltage is applied.

If there is a delay between the application of the forward and the reverse voltages, the number of current carriers decreases, with the length of the interval.

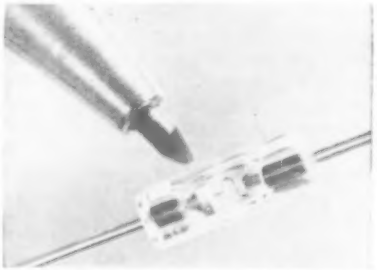
▶ **Similar to a Transistor**—During this transient period of operation under reverse voltage, the diode's action may be likened to the operation of a transistor, NBS points out. In a transistor, the emitter can be viewed as a diode existing in the forward conducting state, and its collector as a diode in the reverse state. If any of the carriers created by this forward-biased "diode" (emitter) are transported to the vicinity of the reversed-biased "diode" (collector), a current larger than static-condition current will flow in the collector.

When a voltage is applied to the transistor emitter, it produces current which creates carriers. These in turn change the static current in the collector. In the case of a junction transistor connected in a common-base circuit, the collector current is almost equal to the emitter current, so that power gain is effectively determined by the ratio of the transistor's forward and back resistance values. Power gain is achieved by in effect transferring current from a low-impedance circuit to another one of much higher impedance.

▶ **Alternate Cycle Operation**—The diode amplifier achieves its power gain in a similar manner, except that one electrode functions both as the emitter and the collector, but at different times. During one half cycle, the anode is more positive than the cathode and acts like an emitter, injecting current carriers into the semi-conductor at a low-impedance level. During the other half cycle, the anode behaves like a collector, withdrawing these same carriers at a much higher impedance level.

One of the simplest forms of diode amplifiers is the resistance-diode-coupled circuit shown on p. 54, Fig. 1. A 1 mc.

TINY DIODES MAY BE AMPLIFIERS in future avionic equipments, permitting size and weight reductions. Compare size of diodes (circle at arrow) with amplifier tubes above them.



COMPARISON with point of mechanical pencil stresses smallness of newer diodes.

says CLEM HENRY,

Pilot, W. C. Langley & Company

"My absolute confidence in Airwork Overhauled engines lets me keep my mind 100% on the job of flying . . . . my boss shares my confidence . . . . we've used Airwork since 1948 for our Twin Beech engine overhauls.

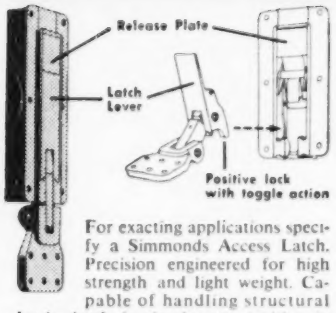
Airwork CORPORATION

Millville, New Jersey

NEW YORK MIAMI WASHINGTON

Flush Fitting, Toggle Action

ACCESS LATCH



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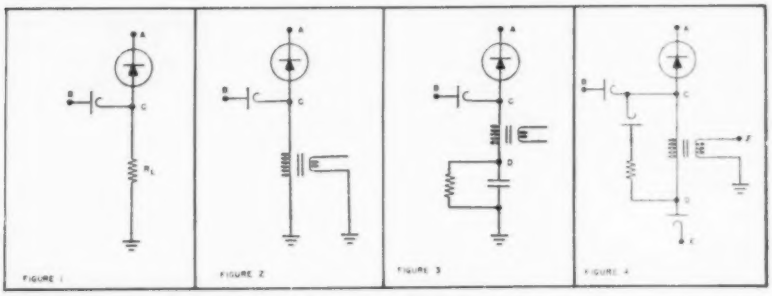
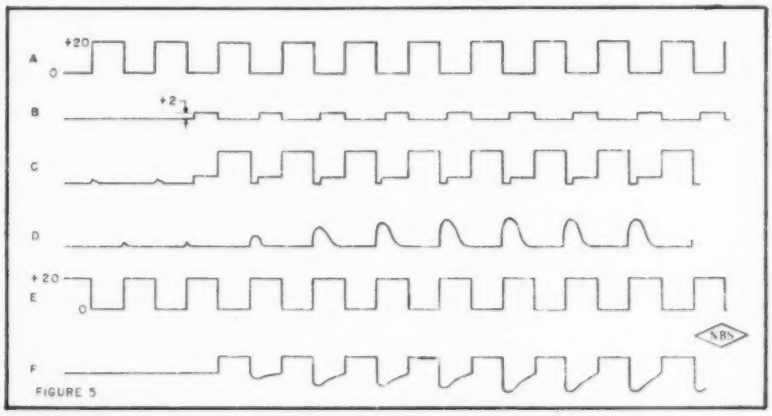


BASIC DIODE AMPLIFIER CIRCUIT developed by NBS is shown in Fig. 1. Figs. 2, 3, 4 show how transformer, capacitor, resistor are added to change circuit's action.



WAVEFORMS at various points in diode amplifier circuit shown in Fig. 4.

power source is applied at point A and the input signal at point B. The 1-mc. frequency was selected because its 1-microsecond period was approximately equal to the carrier decay time in the diodes used.

(Two types of semi-conductor diodes are used in the circuits. One, with conventional short-transient characteristics; the other, the diode amplifier, is selected for its long transient characteristic. To distinguish between the two in circuit drawings, the short-transient diodes are shown using the hot-cathode type diode symbol; the amplifier diode is shown with encircled arrow symbol.)

The RF power supply at point A (clock supply) acts not only as a power source, but also as the switch which controls the two separate stages in the amplification cycle: the intake of signal power, which injects carriers, and the output of amplified signal, which sweeps out the carriers.

► **Simple Amplifier**—When there is no input signal at B, the high back impedance of the amplifier diode prevents any continuous output signal (Fig. 5).

There is a small voltage "spike" due to diode capacities, but this can be decreased by paralleling the load resistor (R_L) with a capacitor for capacitance division.

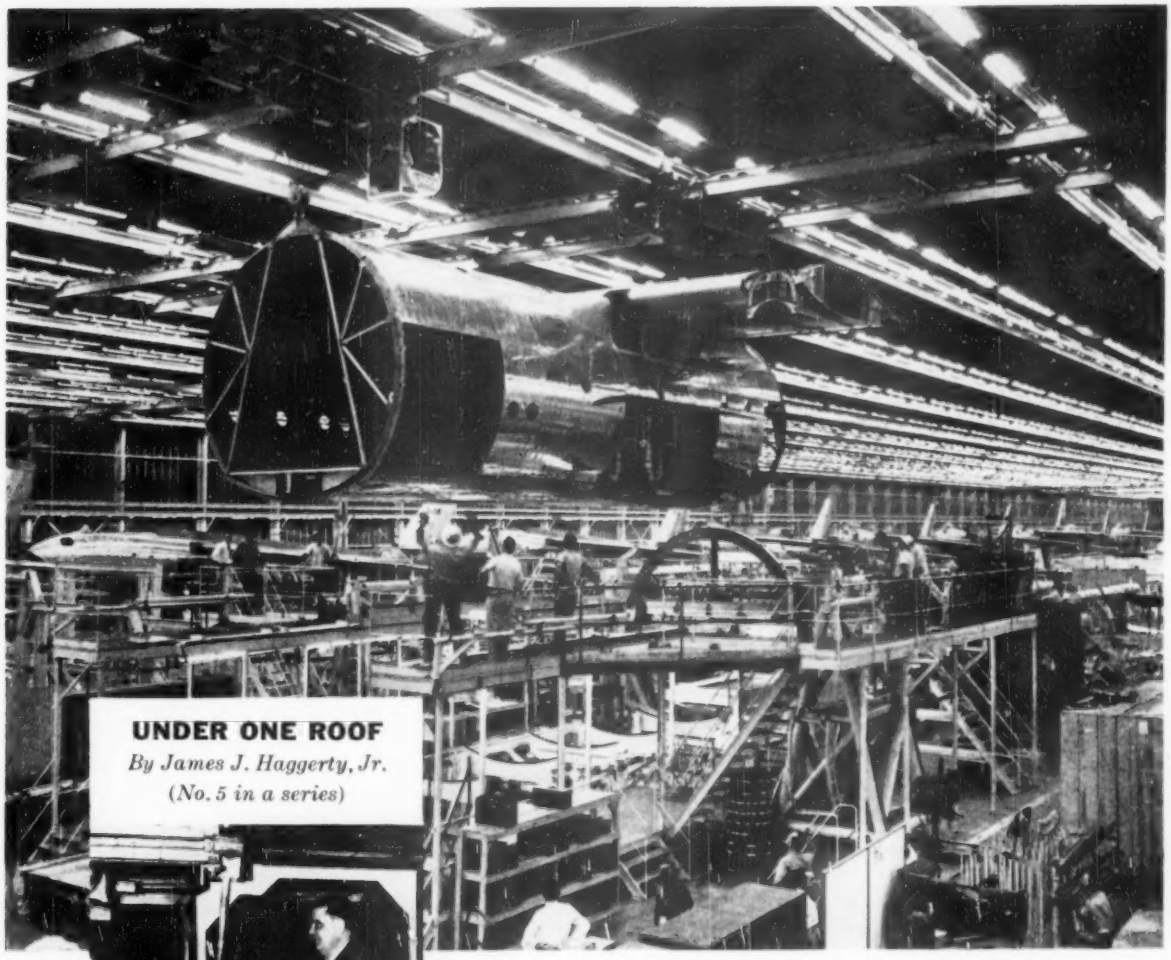
If a small (2 v.) signal is applied at point B when the clock voltage is zero, carriers are injected into the diode by current flowing in the direction B-C-A. When the clock voltage polarity is reversed, these injected carriers cause the diode to present a very low impedance to the reverse voltage for a short period of time. Since this impedance is low compared to the load resistor (R_L), most of the clock voltage appears across the load resistor, as shown in Fig. 5-C.

Using a 20-v. clock supply, power gains of about 10 (average output power/average input power) have been obtained, NBS reports. The only limitation on the amplitude of the clock voltage is that it cannot exceed the diode's reverse breakdown voltage.

NBS points out that the clock supply should have a very low impedance during the time that its voltage is at zero, so most of available input signal power will be applied across the diode.

► **Obtaining Current Gain**—Where current gain is required from a diode amplifier, a step-down transformer can be substituted for the load resistor, as shown in Fig. 2. However, the transformer's inductance prevents rapid recovery between half cycles, limiting the circuit to operation at low duty cycles. By adding a capacitor and resistor in series with the transformer, Fig. 3, the inductance can be balanced out on a many-pulse basis, but not on a pulse-to-pulse basis, NBS says.

A better, but more complex, solution it to excite the transformer primary,



UNDER ONE ROOF

By James J. Haggerty, Jr.

(No. 5 in a series)

"Even the man in the rafters is on the line for teamwork at GAP-6 in Georgia"

Says James J. Haggerty, Jr., Aviation Staff Writer, Collier's

GAP-6 (Government Aircraft Plant No. 6), in Marietta, Georgia, is the free world's largest aircraft manufacturing plant *under one roof*—operated for the U.S. Air Force by Lockheed. It is currently building six-engine B-47 jet bombers and four-engine turbo-prop C-130A military assault transports—and there is room for additional aircraft projects.

GAP-6's main manufacturing building is big with a purpose. Its production areas are serviced by a 26-cab crane system operating over 39 miles of overhead track. Cabs are dispatched by short-wave radio for faster production and reduced man-hours.

The economical use of the radio-controlled crane system is but one example of the facilities available at GAP-6. The entire 76 acres of production floor space under one roof are equipped and laid out to speed the flow of material, reduce long hauling, shorten lines of communication and promote teamwork in manufacture of multi-engine jet aircraft.

These facility advantages are reflected in fewer man-hours and lower costs, making GAP-6 a vital part of America's defense industry.

U.S. Air Force
Govt. Aircraft Plant No. 6

Lockheed
Aircraft Corporation

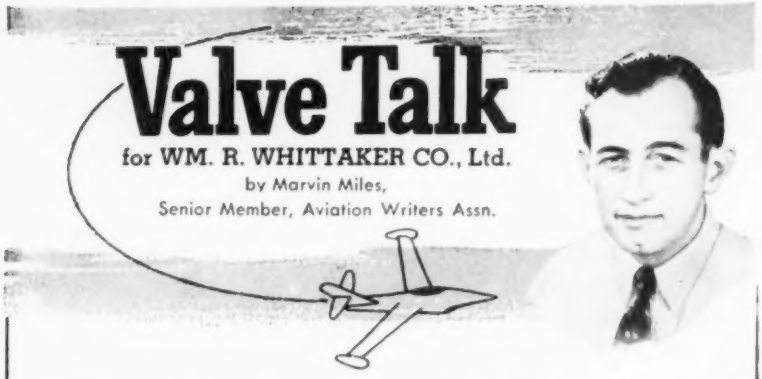
Georgia
Division, Marietta

(a Lockheed advertisement)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.



Whittaker's growth over the years naturally has been paced from time to time by progressive changes in all the company's various divisions—with the most recent change being a new order in Field Engineering, the establishment of a chain of command.

Vice-President Glenn Whitaker heretofore had directed the company's nation-wide Field Engineering operations almost single-handedly, keeping personal tab on virtually every account, every valve, every problem and assuming overall responsibility.

His guidance and coordination of this bustling liaison between production and client, however, had the enthusiastic support of expert staffers, both in the home plant and in the various field offices to the point where Whittaker Field Engineering won matter-of-fact acceptance throughout the industry as an on-the-ball outfit.

Of the various engineers who played important roles in building fast service and goodwill, I'd like to mention three here, although every man in the department deserves an accolade. They are Bill Oman, Art Cocagne and Dick Oblinger who joined Whittaker in successive years, 1949—1950—1951 respectively.

Bill, a World War II B-29 pilot, was in charge of Whittaker's Wichita Field Engineering office until 1951 when Glenn brought him to Los Angeles to handle North American Aviation's home plant, Douglas Santa Monica and Lear, Inc.

Art, also a former Air Force jockey —and known widely for his grin and his nickname, "The Senator"— directed Whittaker's Indianapolis field office, with Allison, General Electric Cincinnati, the Wright Air Development Center and North American Columbus as his principal accounts.

Dick, an armored artillery officer during the recent unpleasantness, handled the company's New York office with primary responsibility for Republic, Grumman, Pratt & Whitney, General Electric Lynn, Fairchild and Bell.

Such was the status quo until recently when two events occurred: (1) Whittaker acquired Schwien Engineering, loading a new and heavy burden of administrative responsibilities on the shoulders of Glenn Whitaker; and (2) Bill Oman, a close assistant to Glenn, resigned to become director of sales for Com-Air Products, Inc., Los Angeles producers of hydraulic and pneumatic aircraft equipment. Bill was respected and well-liked both at Whittaker and in the aircraft industry and he left with the best wishes of everyone from Bob Whittaker on down.

Faced with the fact that he could no longer keep his finger in every Field Engineering pie, Glenn implemented a program he had been considering for some time. He created the position of Director of Field Engineering and appointed Art Cocagne to the Los Angeles job, with North American's home plant as his only account, and appointed Dick Oblinger Eastern Division Director to oversee the New York, Baltimore and Indianapolis offices.

By the first of the year these changes should be in full swing to materially strengthen the entire Field Engineering force, for they will spread the experience of two veterans over broader fields and they have the unqualified support of all engineers in the department. In time other new assignments will be made — changes designed to assure even more comprehensive customer service.

But how about Art and Dick? What kind of men are they?

"Senator" Cocagne we described here once as "serious and reflective, horn-rimmed and bow-tied, with easy wit and a good grin," a man who knows well the value of competence, confidence and cooperation.

Oblinger is a big man, with big booming laugh to match. Like Art he has a deft knack for appreciating both sides of a problem. And it is said he is so thorough that if you ask him what time it is he'll tell you how to build a clock!

These two 36-year-olds will do a real job for Whittaker and Schwien – and for their customers as well – for they have ingrained the field engineer's dual allegiance to company and client.

To be right, it's got to be right both ways!

Fig. 4, through another diode from a clock voltage which is 180 degrees out of phase with the main clock supply at A. When A is positive, point E is at ground potential, and conventional (transient) current flows through path A-C-D-E. In the next half cycle, the power close pulse goes to zero, point E becomes positive, disconnecting the diode between points D and E. During this same time, point B is charging the diode amplifier for the next power clock pulse, and the series diode and resistor between points C and D is providing a discharge circuit for the transformer.

NBS is believed to be investigating means for obtaining intrinsic current gain from a diode amplifier, which would enable it greatly to simplify current-gain amplifier circuitry.

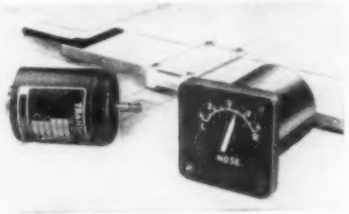
► **Computer Circuits**—Holt has developed pulse-repeater-stage circuitry using a diode amplifier, which can be used to revitalize computer pulses. It consists essentially of a transformer-diode-coupled amplifier and an inhibiting gate. Extra logical "or" (alternative) gates may be added, NBS says.

Holt also has developed a variety of dynamic flip-flop circuits which can remain stable either in an oscillating or a non-oscillating state. One is a current-doubler type whose applied frequency can be varied over a wide range when germanium diodes are used.

► **Silicon Diodes Faster**—Silicon junction diodes, with their much faster transient recovery time, can be operated at much higher frequencies. One experimental NBS current-doubler type of flip-flop, using a silicon junction diode and operated at a 25 mc. clock frequency, exhibited start-stop times of about 50 millimicroseconds, an NBS spokesman told AVIATION WEEK.

With newer, improved silicon diodes, even higher-frequency operation should be possible, NBS concludes.

—Philip Klass



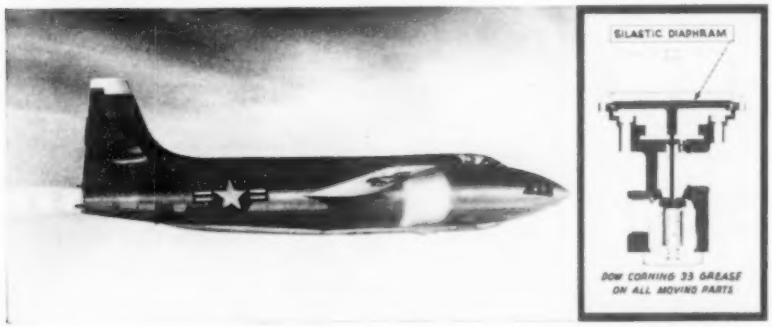
Remote Indicator

Miniature remote position indicator system, using 28-v. d.c. synchros, weighs only 0.4 lb. The 1¾-in.-dia. indicator reportedly is accurate to within ± 5 deg., can be operated between —65F and 160F, up to 60,000 ft. altitude. Transmitter, accurate to within ± 2 deg., can be operated up to 200F. Manufacturer is Avien, 58-15 Northern Blvd., Woodside 77, N. Y.

DOW CORNING CORPORATION

Silicone News

FOR DESIGN ENGINEERS



DOW CORNING SILICONES SOLVE DESIGN PROBLEM IN FUEL SYSTEM OF WORLD'S FASTEST AIRPLANE

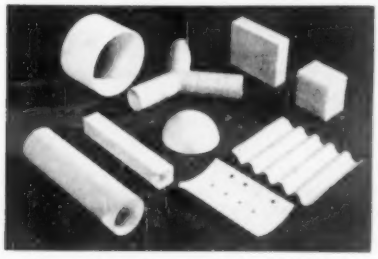
The 1650 mph rocket-powered Bell X-1A is fueled with a mixture of alcohol-water and liquid oxygen. The oxygen supply is held near its boiling point of —297 F and a belt of frost nearly an inch thick collects around the fuel tanks.

The oxygen passes from the supply tanks to the rocket engine through a regulator valve which is controlled by nitrogen gas under pressure. This type of valve works well under normal conditions. At such extremely low temperatures, however, conventional valve diaphragms stiffen and become inoperative. Under certain conditions oxygen is present in the regulator valve and could, in contact with conventional organic lubricants, cause a violent explosion.

Bell engineers successfully solved these two problems with the aid of Dow Corning silicone products. Silastic 250 was specified for the valve diaphragms. Designed to meet AMS 3302B, Silastic 250 retains its rubber-like properties from below —100 to over 500 F.

The explosion hazard was reduced by using Dow Corning 33, a semi-inorganic silicone grease with a serviceable temperature span of —100 to 300 F. Bell's engineers report that this silicone grease "... is compatible with oxygen and therefore can be used as a lubricant in valves which may be exposed to oxygen. Ordinary grease, when used in such places, would be an explosive hazard." *No. 10*

Silicone-glass Laminates Offer Product Designers New Freedom



Silicone and its chemical cousin glass combine here in lightweight structural parts for hot jobs. Dow Corning 2106 is used to bond glass cloth to form laminated tubes, ducts, plates and honeycomb structures. Light, strong and arc-resistant, these parts stand 500 F continuously and short time exposures as high as 700 F. *No. 12*

Ready to use Dow Corning Silicone Foaming Powders produce heat-stable, nonflammable, easily machined, low density foam structures for electrical and thermal insulation. Can be foamed in place and often cured in service. Recently published data sheet describes applications, properties and foaming characteristics. *No. 13*

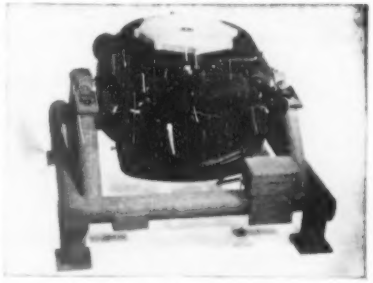
"What's a Silicone?" is the title of a 32 page booklet which answers that often asked question in semi-technical terms. Indexed and illustrated, this booklet has earned an international reputation as the most interesting and informative description of silicones ever published. *No. 14*

Silicone Insulation Protects Shake-Tester Against Overloads

The success of manufacturers producing highly specialized electrical equipment frequently hinges on the trouble free performance of their units. That's why more and more of these manufacturers are building silicone (Class H) insulation into their products.

Take the Calidyne Co. of Winchester, Mass., for example. For six years Calidyne has been manufacturing a line of electro-dynamic "shakers" used to determine the vibration resistance of various assemblies, machines and equipment.

Units to be tested are fastened to a shaker table which is then connected to the armature coil. Vibratory motion is achieved and controlled by the simultaneous passage of an AC current through the armature coil and field of the electromagnet.



No Calidyne shaker has ever been reported burned out, although some are occasionally operated for days at top load. Built in blowers keep the coils cool enough when operated under standard loads. But it's the Dow Corning Silicone Insulation that provides the necessary protection against accidental overloads. *No. 11*

Design Edition 3

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Midland, Michigan

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Avionics Companies Report Changes

Formation of the Mahan Instrumentation Co., specializing in instrumentation research and development, primarily for the aircraft industry, is one of several recently announced additions and expansions in the avionics field. The new company's address is 841 Turquoise St., San Diego 9, Calif.

Other avionics industry expansions include:

• **Elgin National Watch Co.**, has purchased Neomatic, Inc., Los Angeles, which develops and produces miniature avionic components. The move was Elgin's first since it earlier announced plans to diversify its product line.

The new Elgin subsidiary, which employs around 100 people, makes a subminiature relay weighing only 0.035 oz. T. R. Welch, who founded Neomatic, will continue as director of research and development.

• **International Resistance Co.**, maker of resistors, has purchased Van Dyke Instruments, Inc., manufacturer of precision potentiometers. The new IRC subsidiary will be operated by its present management.

• **Magnetic Research Corp.**, El Segundo, Calif., producer of magnetic amplifiers, has moved to new plant at 200 Center St., giving it four times its previous floor space.

• **Eastern Industries, Inc.**, has moved to a new plant at 100 Skiff St., Hamden, Conn. Company's products include small refrigeration units for avionic equipment.

• **Convair Division** of General Dynamics Corp. has been elected to the Radio Technical Commission for Aeronautics.

Neoprene-coated nylon for wing covers, tarpaulins and hangar door curtains.

Available to meet Government Specifications MIL-F-7719 (Aer) and MIL-C-4479 (USAF)

COVERLIGHT has earned a reputation in the field for extra toughness, easy-to-handle lightness, money-saving tear-resistance and weather-resistance. Now COVERLIGHT can be produced to Government Specifications MIL-F-7719 (Aer) and MIL-C-4479 (USAF)! The following styles and types are available:

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Style II, type r	Type II—Class 1
Style II, type nf	

NOTE: there is also a wide range of Vulcan industrial coated fabrics available to meet the specifications of AMS 3270 b, AMS 3274-A and MIL-C-8068 (USAF), Type 1

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FILTER CENTER

▶ **New Computer Technique Stirs Military**—Wright Air Development Center engineers reportedly are enthused over the possibility of extremely simple airborne digital computers opened up by fundamentally new techniques developed by Floyd Steele of Litton Industries. First limited public disclosure, at Wescon of the new techniques which cut number of tubes by a factor of 10 to 20, was reported in AVIATION WEEK Sept. 27, p. 72.

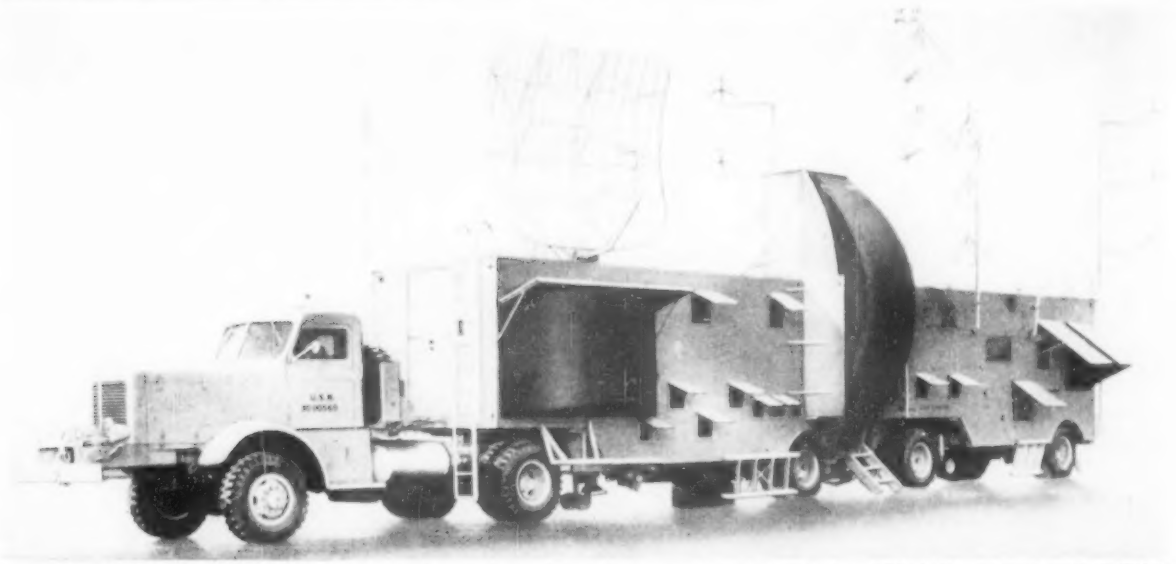
▶ **Wanted: Telemetering Papers**—National Telemetering Conference, scheduled for May 18-20 in Chicago, is looking for technical papers on the subject, particularly on:

• Instrumentation for flight testing aircraft.
• Remote control of missiles and pilotless aircraft.
• Remote control aspects of the automatic factory.
• New components for telemetry.

Contact E. L. Gruenberg, W. L. Maxson Corp., 460 W. 34th St., New York 1, N. Y.

▶ **Wanted: Good Static Air**—Major problem confronting autopilot designers on highspeed jets is obtaining a good static air pressure source for use in constant altitude, airspeed, and Mach number control under all airplane flight attitudes and configurations. Problem, cited by Mel Johnson of General Electric speaking to New York chapter of Professional Group on Aeronautical and Navigational Electronics, is particularly critical in transonic region. Johnson also pointed out that much-improved turn coordination is needed when autopilot closes the loop between an interceptor and its fire control system.

▶ **Airborne Radar for Business Planes**—First installation of airborne storm-warning radar in a business aircraft has been made in a Cornell-Dubilier Electric Co., DC-3 by Remmert-Werner, Inc., St. Louis. The set is a Bendix Radio RDR-1 (X-band). —PK



BENDIX RADIO'S MPN-5 TRAIN consists of tractor, radar trailer and power trailer. Switzerland and U. S. Navy have bought MPN-5.

Bendix GCA Set Stresses Versatility

By George L. Christian

Baltimore—An order for three mobile AN/MPN-5 GCA radar sets has recently been awarded Bendix Radio by the Swiss government. The versatile equipment costs $\$\frac{3}{4}$-million a set, or more than a million dollars when spares are thrown in.

For this price, the buyer gets a ground navigation aid that can land aircraft of all types and sizes in indiscriminate order at a rate higher than can be approached by any other GCA equipment in the world, says Bendix.

The only limitation to the landing rate is imposed by the necessity for clearing aircraft from the runway after landing, according to Bendix.

The company has about half-completed another order, this one for 24 MPN-5 sets for the U. S. Navy, Bureau of Ships.

► **Mobile Pulse Navigation**—Bendix Radio stresses these features of its MPN-5 (MPN stands for mobile pulse navigation at Bendix):

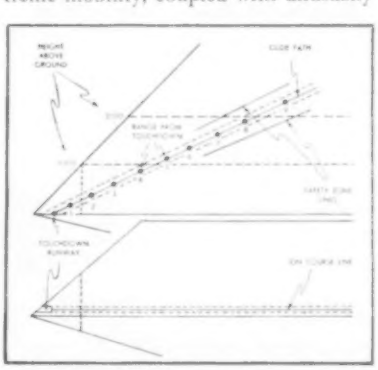
• **Maximum mobility.** The entire set, made up of a powerful tractor and three rugged semi-trailers, is completely mobile and may be driven from one runway to another without ceasing operations. The equipment may also be driven from one airport to another, if the roads will support the rather large and heavy tractor and train.

• **High versatility.** Housed in the MPN-5 are five radar channels and 12 communications sets, giving a total of 171 instantly selectable channels.

Bendix declares the set incorporates "every feature found to be desirable in any previous GCA . . . and has many entirely new developments which have been included for the first time in a mobile radar set."

The MPN-5 has its own self-contained diesel engine power supply. It is air conditioned (both heated and cooled) and carries its own spare parts. Bendix Radio officials say the design of the entire system was predicated on maximum reliability, simplicity, ease of operation and maintenance, and a high degree of accuracy.

► **Mobile & Waterproof**—One of MPN-5's most valuable attributes is its extreme mobility, coupled with unusually rugged, all-aluminum trailer construction and a waterproofing feature which allows the whole train to be submerged to a depth of 5-ft. without damage. In addition, the entire set has also been completely weatherproofed. The truck tractor can run in 5 ft. of water, but the fan belt has to be removed and operation is restricted to 15 minutes. This means that the train could be driven off an LST if water depths do not exceed the 5-ft.-limit.



AZ-EL INDICATOR display shows azimuth and elevation on final approach.

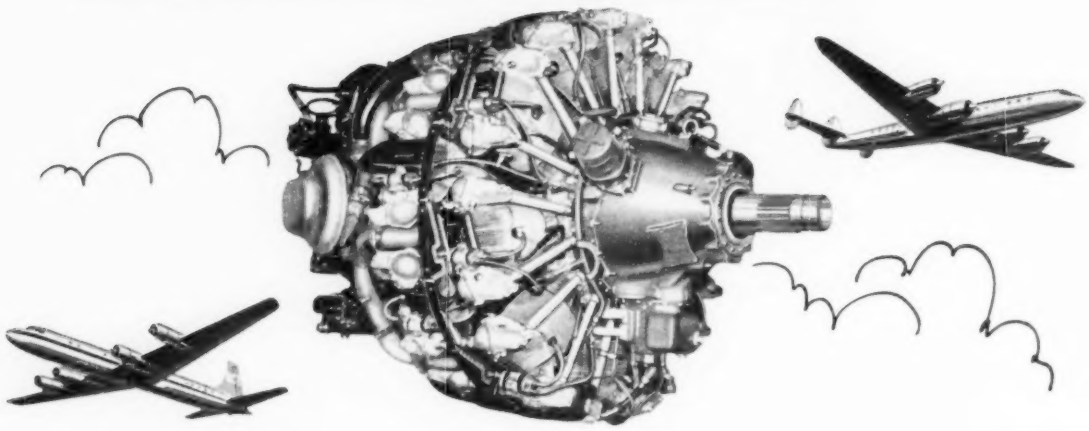
The tractor cab is equipped with radio facilities to allow the driver to keep in touch with the control tower. All radio and radar equipment can remain in operation while the MPN-5 is moving.

Since internal alignment adjustments are included, the MPN-5 need approach its parking area at only approximately the correct angle, after which the equipment can be lined up precisely. Electric jacks are provided to level and brace the trailers.

To insure maximum mobility, the MPN-5 can be driven over any kind of road or across rough, plowed fields. It can be loaded on to the deck or into the hold of a ship (for which special slings have been provided). Or it can be transported by railroad. The equipment may be tilted up to 45 deg. without damage.

Bendix claims: "The MPN-5 can serve as a 50-mile surveillance radar system, a precision approach radar and a complete airport control tower since

27 World Airlines Choose the PROFIT POWER of the TURBO COMPOUND



16.39¢ per revenue ton mile!

Day-in, day-out operation under every condition is proving the Curtiss-Wright Turbo Compound engine to be a real money-maker for the airlines. Its greater profit power, like its greater horsepower, stems from harnessing exhaust gases to give it 20% more output or 20% more range than any other engine of its type.

In the world's fastest long-range transports, the Douglas DC-7 and the Lockheed Super Constellation, the Turbo Compound reduces direct operating costs, exclusive of depreciation, to 16.39¢ per revenue ton mile* – lowest of any modern transports.

And these operating costs will go still lower! Current maintenance costs for this still relatively new engine type account for 3.30¢ per revenue ton mile. As experience and time are built up in engine maintenance routines, this figure will fall, providing still greater savings to airline operators.

*Based on actual U.S. airline domestic operations for the first 6 months of 1954. Depreciation has been excluded because of wide variations in airline depreciation rate policies.

Turbo **C**ompounds = greater **T**onnage at lower **C**ost

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CORPORATION . WOOD-RIDGE, N. J.

World's Finest Aircraft Engines

Curtiss-Wright extends its appreciation to these major airlines, whose selection of the Turbo Compound has opened a new era of economical, high-speed transportation around the world:

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LINEA AEROPOSTAL VENEZOLANA
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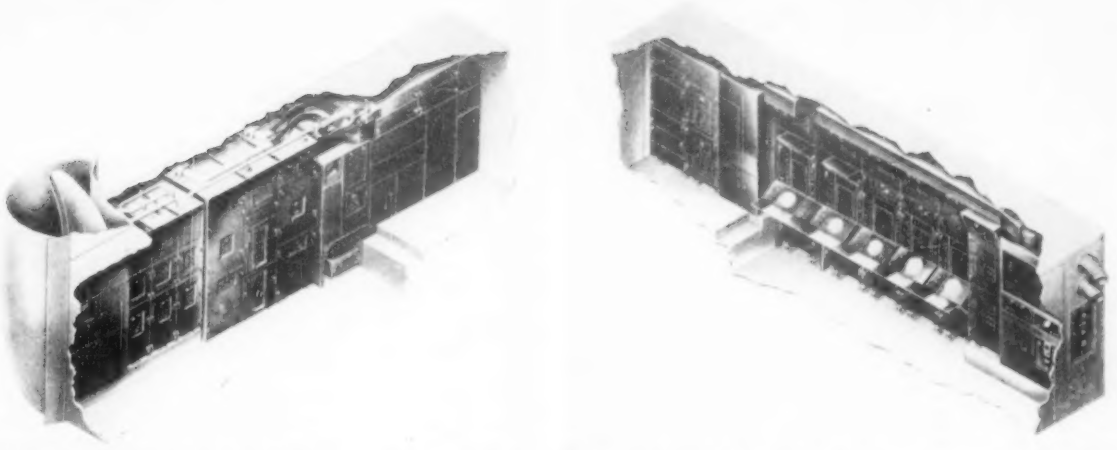


RADAR TRAILER—Road side (left) shows part of PAR vertical antenna, control panels, etc.; curb side (right) shows scopes and indicators.

it includes wind direction and force instrumentation plus an altimeter setting instrument as standard equipment. Spare parts are carried to assure an extended period of self-sufficient operation. The stand-by diesel also can be used to supply 25-kwa., 60-c., 3-phase a.c. current for other airport equipment or for runway lights, if desired."

▶**New Developments**—C. W. Hicks, director of international sales of Bendix Radio Sales, and former systems engineer on the MPN-5, told AVIATION WEEK that the company pioneered a number of new developments for the MPN-5.

Bendix designed all components of the MPN-5 to be completely compatible with each other, rather than group independent components. This is the only way to assure a completely satisfactory system, Hicks says.

To assure the greatest simplicity possible in the radar trailer's wiring (there is over 25,000 ft. of wiring in that one trailer alone), no splices were allowed. Each wire can be removed and replaced without disturbing adjacent wiring because each individual wire starts and ends at a terminal.

To keep the trailer from wobbling and bobbing as the scanning antennas oscillate through their arcs, two Bendix-conceived ideas are used.

• **Antenna** is made of plastic with aluminum wire screening imbedded in its surface. This slices the unit's weight some 75%—from over 100 lb. to about 25 lb.

• **Sinusoidal motion** is given to antenna to eliminate sudden changes of direction which might cause the trailer to bob.

▶**Deflatable Radomes**—The radomes for the horizontal and vertical antennas of the PAR (precision approach radar) are novel. They are made of a synthetic rubber by-product and are deflatable, so they may be stored in a small space when the MPN-5 set is not in use or is on the road.

The radomes hold their shape because of the cut of the material and the inflation of a 2-in. air space between the radome's two layers. It is necessary to keep this air space constant to within about ⅛-in., because a greater variation would cause attenuation of the radar's transmitted and received signals. To accomplish this, a series of small threads are attached to the inner and outer layers of the radome to keep the separating distance between them constant within the desired tolerance.

▶**What's in It**—Here are the facilities MPN-5 provides:

Five simultaneous radar operating positions. Two are PPI (plan position indicator), two Az-El (azimuth-elevation), plus one combination position. The combination position is equipped with all plugs and cables to operate either a PPI or Az-El indicator as desired. Changeover can be accomplished in five minutes.

Provisions have also been made to operate pairs of PPIs and Az-Els remotely as far as 100 feet. This allows the radar equipment to be set up in the ready room in the spare parts trailer.

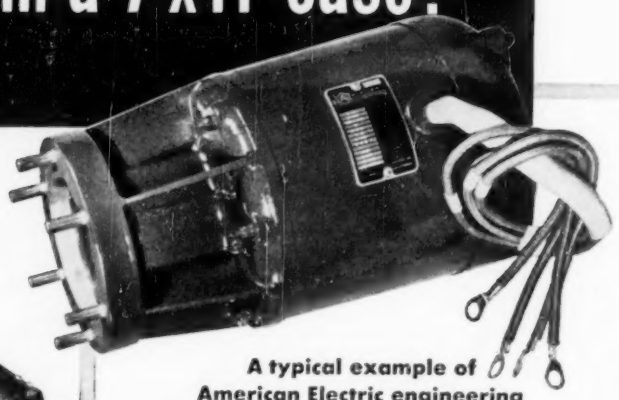
Each of the operating positions may be equipped with controls of up to a total of four complete communications units—one LF (low frequency), one HF (high frequency), one VHF (very-high frequency), and one UHF (ultra-high frequency) set or any combination of these units.

Two-way selectable intercommunications are provided between all five positions, an outside observer and the control tower. Included in the radio array of the MPN-5 are five ARC-27, five ARC-1, two ART-13 and two ARR-15 communications sets.

Extensive use of signal lights at each position shows which communications channels are in use at all other positions, which final controllers are occu-

POWER TRAILER contains diesel generators and array of communications antennas.

15 Horsepower in a 7"x11" case!



A typical example of American Electric engineering

This 400 cycle 3 phase motor for driving a hydraulic pump is a special aircraft design, custom-developed by American Electric Motors Inc. Rated at 15 h.p. continuous duty at 11,500 r.p.m., it actually produces 19 h.p. on intermittent duty, yet occupies less than ¼ cubic foot. A special case made of magnesium holds weight down to a mere 32 lbs. or approximately ½ h.p. per pound. This motor is fungus-proof, corrosion resistant, meets AND 20002 type XIIB mounting specifications and is sealed against hydraulic oil. It operates within a temperature range of −67° to +131° F. Overall length of the motor unit is 7" with a 4" coupling extension.

MINIATURE MOTORS for all PURPOSES

In addition to engineering such "specials" described above, American Electric makes an almost unlimited range of miniatures for 60 and 400 cycle, and variable frequency operation. These feature low weight and compact size, meeting high temperature requirements. With our wide variety of completed tooling, laminations are available for almost any miniature motor requirement without design compromise or delay.

INDUCTION OR SYNCHRONOUS TYPES—Both reluctance and hysteresis motors are available in the synchronous type.

APPLICATIONS—American Electric Miniatures are available for all *drive requirements*, for *propeller fans* and *centrifugal blowers*. Let us quote on your requirements. Wire, write or phone today!

Variable frequency motors in these blowers and fans operate at minimum watts loss over the full range of frequencies encountered with aircraft power supplies—from 320 to 1000 c.p.s. CFM output of blowers is substantially uniform over full frequency range at atmospheric pressure. RPM rises at high altitude, increasing velocity and cooling ability.

Also Manufacturers of High Cycle Motor-Alternators and A.C. Industrial Motors.

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pied, and whether or not the runway is clear. (The last indication comes direct from the control tower.)

All radar controls are shape- and color-coded and are lighted for quick and easy identification. Push-to-turn couplings are incorporated where necessary to prevent controls being operated inadvertently.

► **Completely Dual**—Complete standby units have been provided for all radar and associated power equipment. Provisions have also been made to keep standby radar equipment "preheated" so that it can be brought into instantaneous use through conveniently located control switches in case the operating channel fails.

In the MPN-5's power supply set-up, three diesel engines drive the necessary electrical generating equipment. Any one diesel can supply sufficient current to operate a single ASR (airport surveillance radar) channel and a PAR. Any two diesels can provide full dual channel (operating and standby channels) operation.

The full complement of three diesels provides full dual channel operation plus air conditioning. The latter is provided for operator's comfort and is not essential to radar operation.

► **Easy to Maintain**—Ease of maintenance is one of the main design features of the MPN-5. Among the many devices used by Bendix to achieve this goal are:

• **All chassis are mounted** on ball-bearing drawer slides to simplify inspection and repair without interfering with operation or the functioning of other units.

• **Red light** automatically comes on if a radar unit is kept operative in the maintenance position. This serves the dual purpose of providing illumination and a warning that dangerous voltages are present.

• **Tubes may be changed** through access doors without moving the chassis or being exposed to high voltages. Additional doors allow various points, including the rear of all connecting cable plugs, to be inspected.

• **All plugs, wires, terminal boards** and terminals are easily identified through a system of coded numbers which are cross-indexed in a wiring book.

• **Adequate working space** has been provided so that any faulty wires may be replaced quickly. Bendix estimates that "the most serious wire failure should be readily found in five minutes."

► **Approach Radar**—When designing and building the precision approach radar components of the MPN-5, Bendix engineers strove for the greatest possible accuracy. They came up with a completely new precision system, salient features of which are:

• **Antennas.** Horn fed, shaped an-

Federal *transformer-rectifiers provide power for the*

MIGHTIEST little bomber in the world!

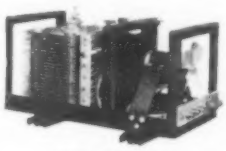
THE DOUGLAS A4D SKYHAWK is America's newest flying answer to aggression... a *bantam* bomber with an *atomic* punch.

A product of revolutionary techniques in engineering, tooling and production, the Skyhawk is the smallest and lightest jet combat plane ever built... less than *half* the size of many current operational jet fighters. Spanning only 27 feet, the midget-sized Skyhawk is capable of crossing the country nonstop!

Dependable AC conversion, so indispensable to the DC requirements of the world's mightiest plane for its size, is supplied by two Federal selenium rectifier power supplies... the FTR-3146-BS2, a 55-ampere transformer-rectifier unit... the FTR-3499-AS, a 12-ampere DC conversion unit.

These vital power supplies in the Skyhawk are further proof of the ruggedness and efficiency of *selenium* rectifiers for aircraft applications... the reliability of Federal performance... the flexibility of Federal design and manufacturing experience.

Whatever your DC requirements, Federal is ready to serve you. Write to Dept. E-8110.



FTR-3146-BS2
55-ampere
Transformer-Rectifier

FTR-3499-AS
12-ampere
DC Conversion Unit

Federal
Telephone and Radio Company

A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

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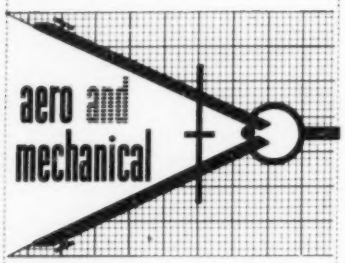
Engineers



If you have the sort of creative ambitions that can only be satisfied with work on the highest level of new and advanced aerodynamic concepts, then you owe it to yourself to look into the spectacular career opportunities at All American Engineering.

Here is an established, forward-looking organization offering the aviation industry a complete service from creative idea to fabricated prototype. In this progressive atmosphere, where new concepts in flight are daily being given actual form, you can build an unusually fine and fascinating career in such fields as these:

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tennas are used to cover the entire glide path at all times. This wide coverage picks up considerable ground clutter, but this is immediately canceled out by inclusion of an advanced form of X-band MTI (moving target indication—a means of having the radar distinguish between stationary and moving objects).

• **MTI.** Presentation of the MPN-5s is straightforward, simple and clean, says Bendix. Targets are sharp, leave good trails and "background" can be adjusted as desired to show up obstacles without cluttering up the scope.

• **Angle data system.** The MPN-5 uses a simple, foolproof and completely adjustable d.c. source system incorporating precision potentiometers which allow exact linear reproduction of the antenna angle on the cathode ray tube throughout the entire scan.

Simple and accurate non-electronic adjustments are provided for approach path, glide slope, waveoff marks, etc., say Bendix engineers, and the entirely mechanical adjustments have the accuracy of a good micrometer. Reading the scan scale on both azimuth and elevation systems is accurate to 0.01 deg. throughout the entire scan. Potentiometers are rugged and durable and change from one to another can be made in a matter of seconds without degradation of the display. Frequency changes do not affect the angle data system alignment.

• **Yokes.** Since the display on the CRT is only as good as the yoke which translates the data into a radar presentation, Bendix designed a completely new set of yokes for the MPN-5. Company engineers say that, through the use of these new yokes, "a degree of accuracy never before attained in any radar set has been achieved in the MPN-5. Sweep circuit alignment is possible to the end that all 'hooks' or curves are completely eliminated."

• **Presentation.** Bendix says that the simultaneous and continuous presentation of both azimuth and elevation data by MPN-5 radar is a complete departure from the original Az-El display where only one scan at a time was presented.

The Bendix MPN-5 gives a smooth, uninterrupted display over a ten mile range. A non-linear sweep is used so that three miles takes up about half of the display.

► **Surveillance**—The MPN-5's surveillance system provides 500-kw. transmitter peak output, a receiver-MTI combination with gain of better than 95 db. and an antenna gain of 34 db. Design of the antenna makes horizontal or vertical polarization possible. All operating motors and servos are mounted within the trailer to protect them from the elements and make them accessible for servicing.

• **MTI.** The surveillance MTI is a very efficient system, Bendix Radio says. The equipment is extremely stable because of the highly precise regulation of all voltages used with system.

• **Display.** The 12-in. CRT displays ranges of 5, 10, 20, 30, and 50 nautical miles. Off-centering is provided for in any direction up to one radius. Unit includes a specially designed yoke featuring simplicity and reliability.

• **Rotating joint.** The system's rotating joint can handle over 1,000 kw. peak power. To insure simplicity, the channel switch has been made part of the rotating joint.

• **Range.** Bendix quotes the consistent range of the XN-1 Model of the MPN-5 as being 40 nautical miles on a fighter type aircraft at 10,000 ft. BuShips' spec requirements are 31 miles. This range is obtained on MTI as well as on "normal" operation.

► **Backlog**—W. E. Cleaves, Bendix Radio's General Sales Manager, told AVIATION WEEK that his division has a cur-

ARDC Tests Thrust Reverser on J65 Jet

Experimental thrust reverser, designed and built at Air Research and Development Command's Wright Air Development Center, employs series of cascades surrounding two movable "flippers."

Flippers form aft surfaces of vertical fixed airfoil-section, which hinge out from nose portion to deflect fast exhaust stream through rings of cascade on F-84F tail.

WADC's Power Plant Lab's Engine Installation Branch is working on scheme to retract flippers inside recess in cascade, and to retract cascade itself between fuselage and tailpipe, with reverse thrust is not required. With ultimate configuration, thrust loss is expected to be about 1%. Developers hope to keep added weight under 120 lb.

from design to delivery.....

you can rely on Weber for dependable aircraft equipment. This has been proven by the many products in service today for the Armed Forces and commercial airlines. Requirements for all types of fixed and ejection seating are being fulfilled in new aircraft. Call on Weber Engineers for help on your aircraft equipment problem. You can depend upon their solution.

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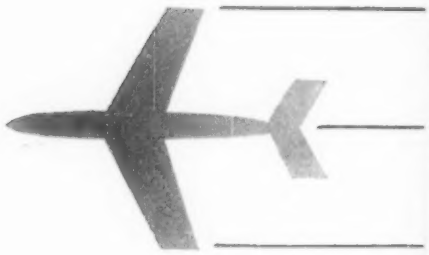
Subsidiary of Weber Showcase & Fixture Co., Inc.

Saginaw offers

and multiple circuits in ball bearing screws offer multiple advantages



- **less weight** In a Saginaw Ball Bearing Screw every ball carries its share of the load. No balls "go along for the ride", simply as spacers. Thus, far fewer balls are required and therefore a substantially shorter, smaller and lighter nut is necessary to contain the balls for a given load.

- **greater capacity** Conversely, a nut of a given length is capable of carrying a substantially greater load than those of other designs. Thus, either way, a Saginaw Screw is advantageous.

- **increased efficiency** Because with multiple circuits, no more than 3½ turns for each circuit are required, the balls operate with greater fluidity — and maximum efficiency.

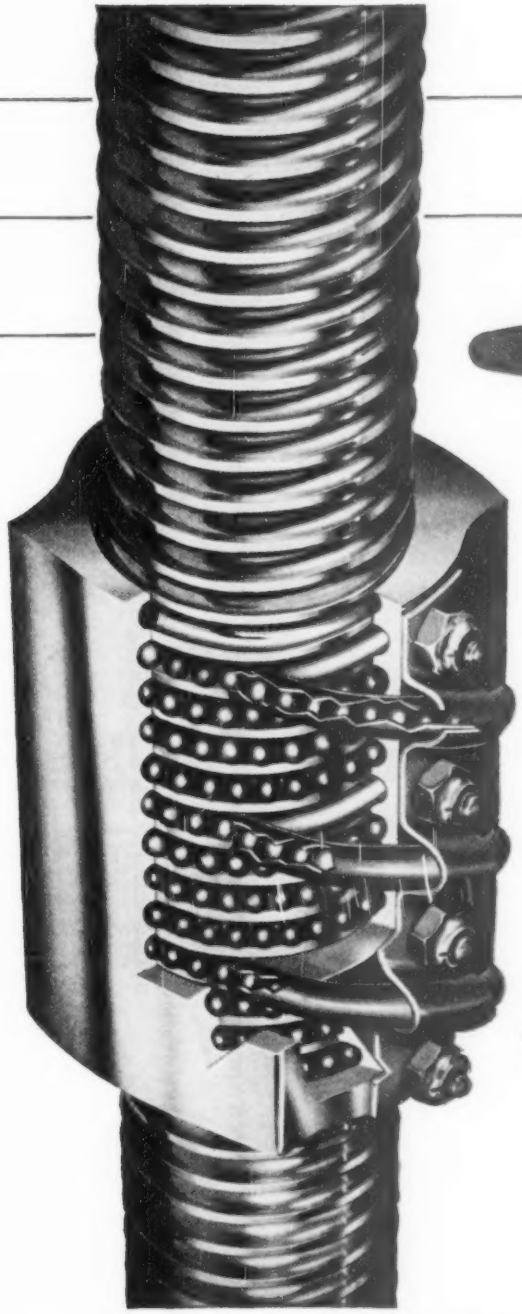
- **insured safety** In the rare event of a ball-failure, in a multiple-circuit Saginaw Screw, only one circuit is inactivated, and the other circuits "carry on".

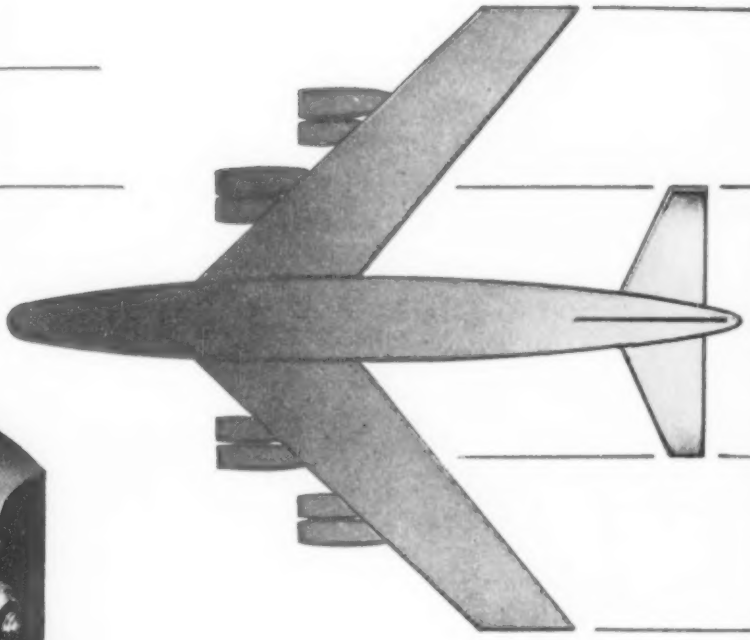
- **experience for you** The Saginaw Steering Gear Division pioneered in the development of the recirculating ball-nut screw. The continuous research and development of the engineering staff is available to help you increase the dependability and efficiency of the actuators in your product, and to cooperate with you on any new applications you may have.

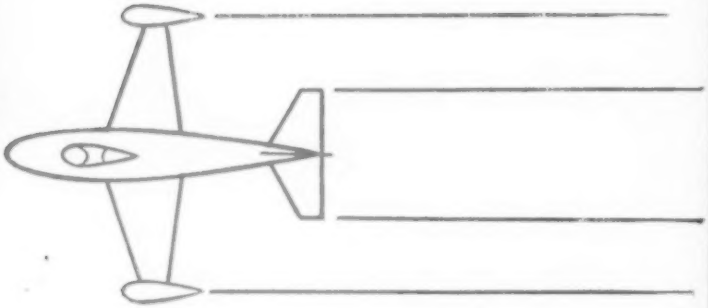
Saginaw Screws can be supplied in 1, 2, or 3 circuits and in a complete range of load and life requirements for use with electrical, hydraulic or pneumatic units. Write today for our free engineering data book.

Saginaw STEERING

multiple circuits...





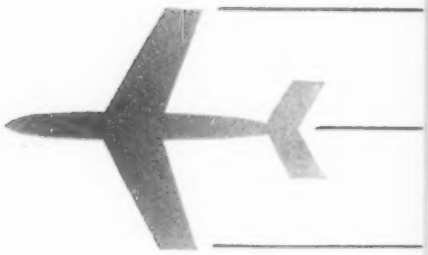


GEAR DIVISION

GENERAL MOTORS CORPORATION • SAGINAW, MICHIGAN
MANUFACTURERS OF SAFETY POWER STEERING

Saginaw offers

and multiple circuits in ball bearing screws offer multiple advantages



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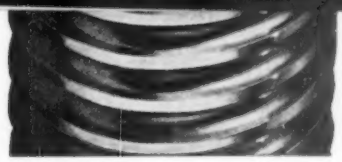
- **greater capacity** Conversely, a nut of a g greater load than those of other designs. Thu
- **increased efficiency** Because with multip are required, the balls operate with greater

MISNU

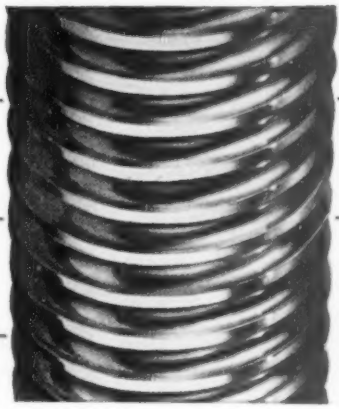
- **insured safety** In the rare event of a ball-failure, in a multiple-circuit Saginaw Screw, only one circuit is inactivated, and the other circuits "carry on".
- **experience for you** The Saginaw Steering Gear Division pioneered in the development of the recirculating ball-nut screw. The continuous research and development of the engineering staff is available to help you increase the dependability and efficiency of the actuators in your product, and to cooperate with you on any new applications you may have.

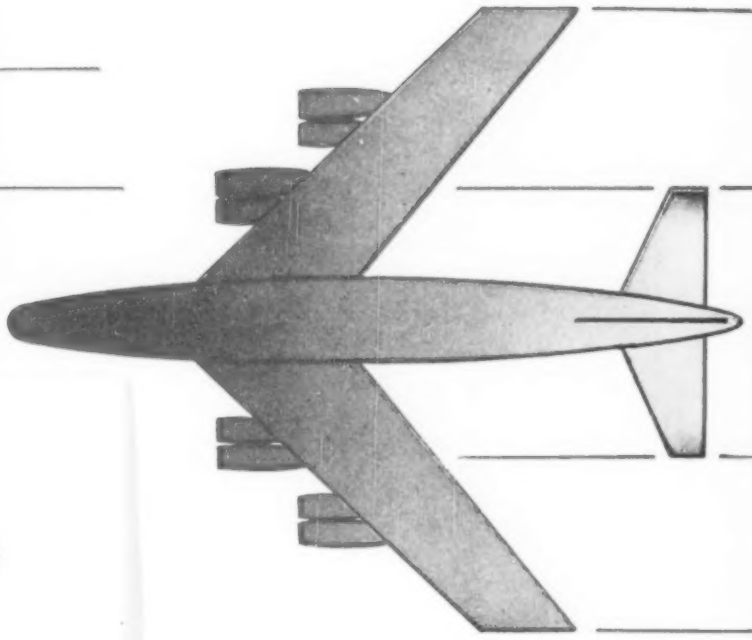
Saginaw Screws can be supplied in 1, 2, or 3 circuits and in a complete range of load and life requirements for use with electrical, hydraulic or pneumatic units. Write today for our free engineering data book.

Saginaw STEERING



multiple circuits...





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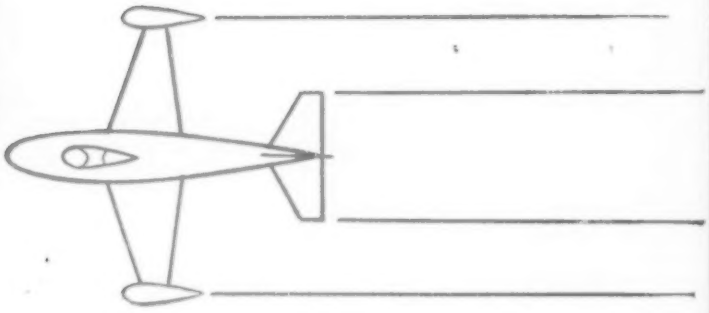

GEAR DIVISION

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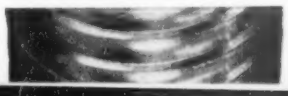

Cppc's SIZE 10 and SIZE 11 SERIES SYNCHROS Available Now!

In quantity production . . . available for immediate delivery . . . is this high performance series of standard Size 11 Synchros . . . 1.062" diameter.

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LOOK TO cppc FOR SYNCHRO PROGRESS

CLIFTON PRECISION PRODUCTS CO., INC.

CLIFTON HEIGHTS **PENNSYLVANIA**

rent backlog of over $4 million in aviation sales. Total commercial backlog is $8 million.

He also notes a substantial increase in sales of equipment to corporate aircraft owners. He says that 1954 sales jumped 100% over 1953, and predicts that in 1955 the increase will be 100% over 1954.

Boeing Gives Details On 707 Gear Failure

Detroit—A detailed analysis of why Boeing's four-jet 707 tanker/transport's brakes failed on landing Aug. 5 (AVIATION WEEK, Aug. 16, p. 377) was given here by Ed Pfafman, Boeing assistant project engineer-systems, at the Vickers 1954 Transport Aircraft Hydraulic Conference.

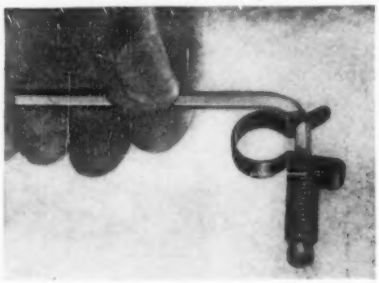
The analysis was contained in a paper which Pfafman delivered, entitled "Design of the Hydraulic System for the Boeing 707 Transport."

Here are the facts as Pfafman cited them:

▶ **Bad Breaks**—Boeing's chief test pilot, A. M. (Tex) Johnston, had all the breaks against him that evening of August when the 707 wound up in a ditch with "a badly bruised nose."

- He was making his first night (actually it was twilight) landing in the 707.
- He was making his first landing with the 707's landing weight over 100,000 lb.—it grossed about 130,000 lb.
- He was checking elevator effectiveness and so held the 707's nose off the ground until the last second. This meant that the brakes were not applied until the nose gear was lowered to the runway—and less than 2,000 ft. of concrete remained.

Pfafman outlined this sequence of mechanical events leading up to the brake failure, so that, as he put it, "none



Key Holder

Key Klip holds hex key in head of hex screw, providing a semi-permanent handle to the screw for tightening. It is easily removed when desired. Manufacturer suggests it is especially useful for repetitive operations where hex set screw must be tightened and released. It comes in ¼, 5/16 and ⅜-in. sizes. Maker is Vlier Engineering, Inc., 4552 Beverly Blvd., Los Angeles 4, Calif.

FLAME-PROOF FABRIC CONNECTOR ELIMINATES "fire zone" fatigue

CASE HISTORY

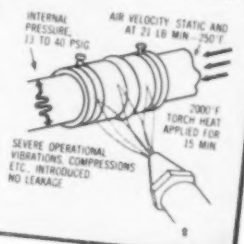
ARCOSIL RUBBER IMPREGNATED FIBERGLASS CONNECTOR PERFORMS AFTER 2000° FIRE TEST

To eliminate fatigue failures of metal connectors on aircraft supercharger intake ducts, Arrowhead designed a replacement part from ArcoSil silicone rubber fiberglass material. Tests were made to determine fire-resistant and fire-proof characteristics of supercharger inlet duct connector.

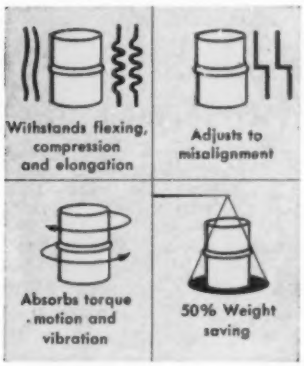
TEST CONDITIONS: Required to withstand 2000° F. flame for 15 min. Pressure: 13 PSIG. Internal air flow: static and 21 lb./min. at 250° F. internal air temperature.

RESULT: After severe flexing, conductor withstood 40 PSIG pressure with no leakage.

C.A.A. APPROVED.


INTERNAL PRESSURE, 13 TO 40 PSIG
AIR VELOCITY STATIC AND AT 21 LB MIN.—250°F
2000°F TORCH HEAT APPLIED FOR 15 MIN
SEVERE OPERATIONAL VIBRATIONS, COMPRESSIONS ETC. INTRODUCED NO LEAKAGE

ArcoSil connector replaces metal on supercharger intake duct


Withstands flexing, compression and elongation
Adjusts to misalignment
Absorbs torque - motion and vibration
50% Weight saving

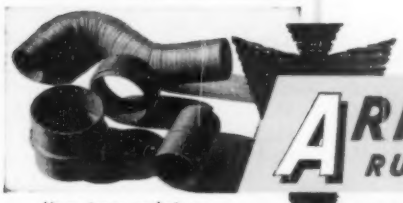
ARCOSIL FIBERGLASS DUCTING OFFERS *NEW* DESIGN APPLICATIONS

New techniques developed by Arrowhead in fabricating complex ducts, sleeves and couplings from ArcoSil flexible silicone rubber impregnated fiberglass have opened amazing new design possibilities. In addition to ArcoSil's ability to withstand heat, vibration and torque-motion-fatigue, the materials permit the parts to be formed to almost any conceivable shape and size to meet individual specifications.
A variety of standard constructions offers serviceability under extreme high and low temperatures and at various pressures.

Close tolerance tooling and production costs are cut to a fraction, as compared with metal, to effect sizeable savings in either experimental or production quantities. Up to 50% weight reduction is possible.
Flexibility permits crushing without damage and simplifies installation.

Arrowhead specializes in solving difficult flex-connector problems in fuel, oil and air systems. Arrowhead field engineers will gladly provide further information and assistance.

WRITE FOR ENGINEERING BULLETIN
describing complete line of ducts, sleeves and couplings.



Many types and sizes

ARROWHEAD RUBBER COMPANY

Division of Rohr Aircraft Corporation, Inc.

2330 CURRY STREET, LONG BEACH, CALIFORNIA

Pioneer fabricators of silicone rubber; Originators of rubber-fiberglass ducting

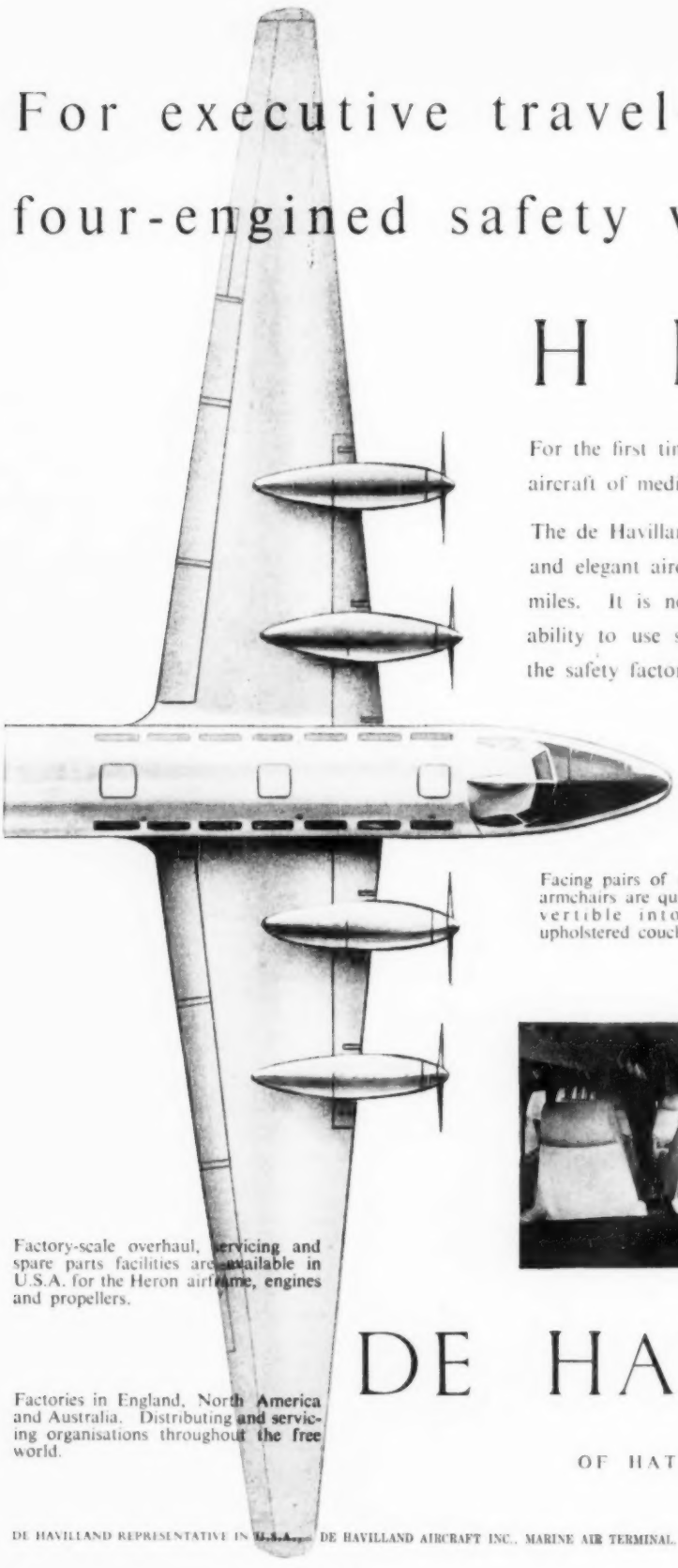
For executive travel—

four-engined safety with economy

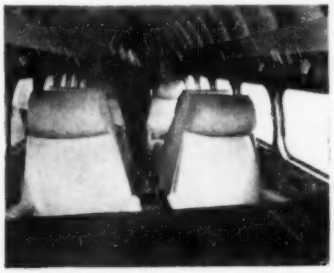
HERON

For the first time, a completely new four-engined transport aircraft of medium size is available to the executive.

The de Havilland Heron is a modern, efficient, economical and elegant aircraft, for stage lengths of up to 1,500 statute miles. It is not too big and not too small; it has the ability to use small airfields and—very important—it has the safety factor of four engines.



Facing pairs of adjustable armchairs are quickly convertible into softly upholstered couches.



Standard executive arrangement seats eight in luxury. Folding full-width tables between chairs.

Factory-scale overhaul, servicing and spare parts facilities are available in U.S.A. for the Heron airframe, engines and propellers.

Factories in England, North America and Australia. Distributing and servicing organisations throughout the free world.

DE HAVILLAND

OF HATFIELD, ENGLAND

DE HAVILLAND REPRESENTATIVE IN U.S.A.: DE HAVILLAND AIRCRAFT INC., MARINE AIR TERMINAL, LAGUARDIA AIRPORT, FLUSHING, N. Y. TEL. DEFENDER 5-3371

of you responsible for hydraulic design will repeat the same mistake."

▶ **Contributing Factors**—Four items actually contributing to the brake failure were:

- Excessive use of brakes immediately prior to takeoff.
- No brake line bleeding after removal of test equipment.
- Excessive volume of oil in the brake piston.
- Installation of fuses in the deboost valve.

Design of the fuses requires 50 psi. hydraulic pressure in the lower section of the deboost before the pintle rises, allowing the low-pressure side to refill in case the brake capacity exceeds the deboost capacity. A similar fuse installation in the B-47 has given very satisfactory service, according to Pfafman.

Before taking off on the flight which ended in brake failure, Johnston ran the 707 through several brake tests. Then, with brakes still hot, he took off and climbed to high altitude. This caused the hydraulic fluid trapped in the brake piston to boil, forming vapor which drove the oil back through the line into the deboost where the pressure was relieved by a ball check valve. When landing gear was extended at high altitude, hydraulic lines to the brakes and the brakes themselves cooled rapidly. Thus a partial vacuum formed, pulling the deboost piston to the bottom of its chamber. Since no pressure was exerted, the pintle was not actuated to allow lines to be refilled.

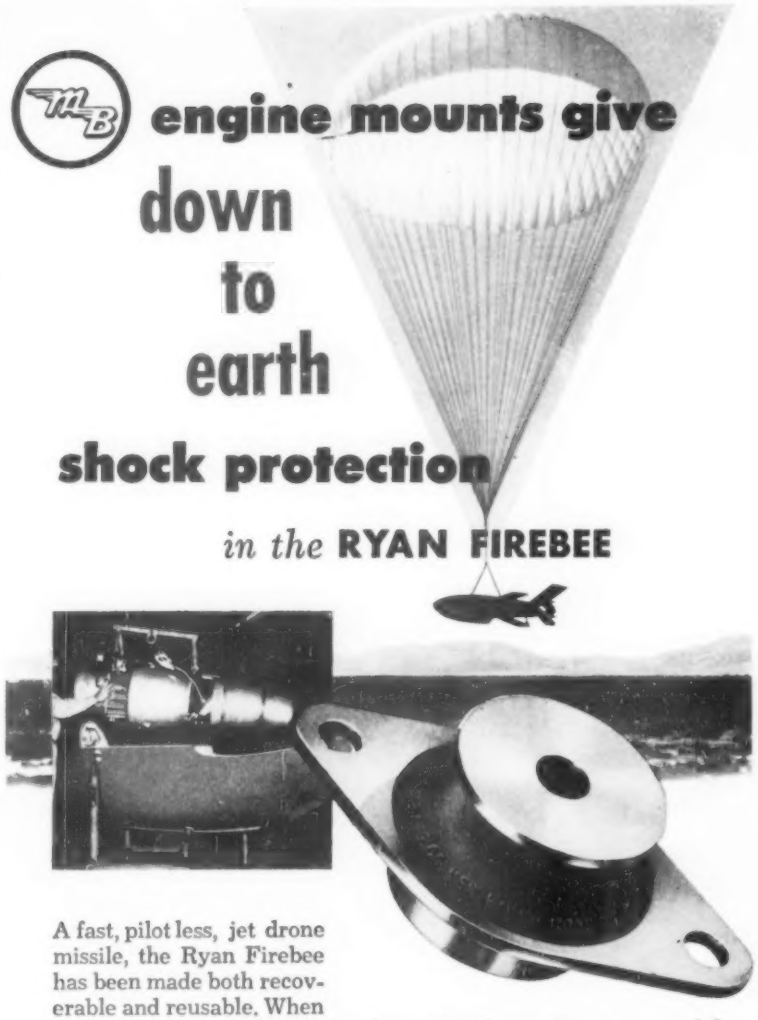
So, when Johnston landed the 707, all cockpit indications were normal, yet it was physically impossible to get hydraulic pressure past the deboost. Result: one "badly bruised nose."

WHAT'S NEW

Telling the Market

Dexter Machine Products, Inc., Chelsea, Mich., has published an 8-page brochure entitled, "A Down to Earth Story of Precision Instrument Gear Costs," which analyzes various factors going to make up gear cost and tells what Dexter's place in the field is . . . . Latest information on Kaiser **aluminum mill products and services** is given in 24-page booklet available from Kaiser Aluminum & Chemical Sales, Inc., Industrial Service Division, 1924 Broadway, Oakland 12, Calif. . . . **Pancloc high-performance aircraft fastener**, engineered to meet requirements of National Aircraft Standards Committee's Spec NAS 547, is described in brochure available from Scovill Mfg. Co., Aircraft Fastener Div., Waterbury, Conn. The Spec, issued by NASC on Mar. 1, 1954, calls for a high-strength, quick-

MB engine mounts give down to earth shock protection in the RYAN FIREBEE



A fast, pilotless, jet drone missile, the Ryan Firebee has been made both recoverable and reusable. When fuel runs out, it parachutes to earth. Its small yet powerful Continental J-69 engine finds additional, practical protection against landing shock damage—in its MB Type 508 Isomode* Engine Mounts.

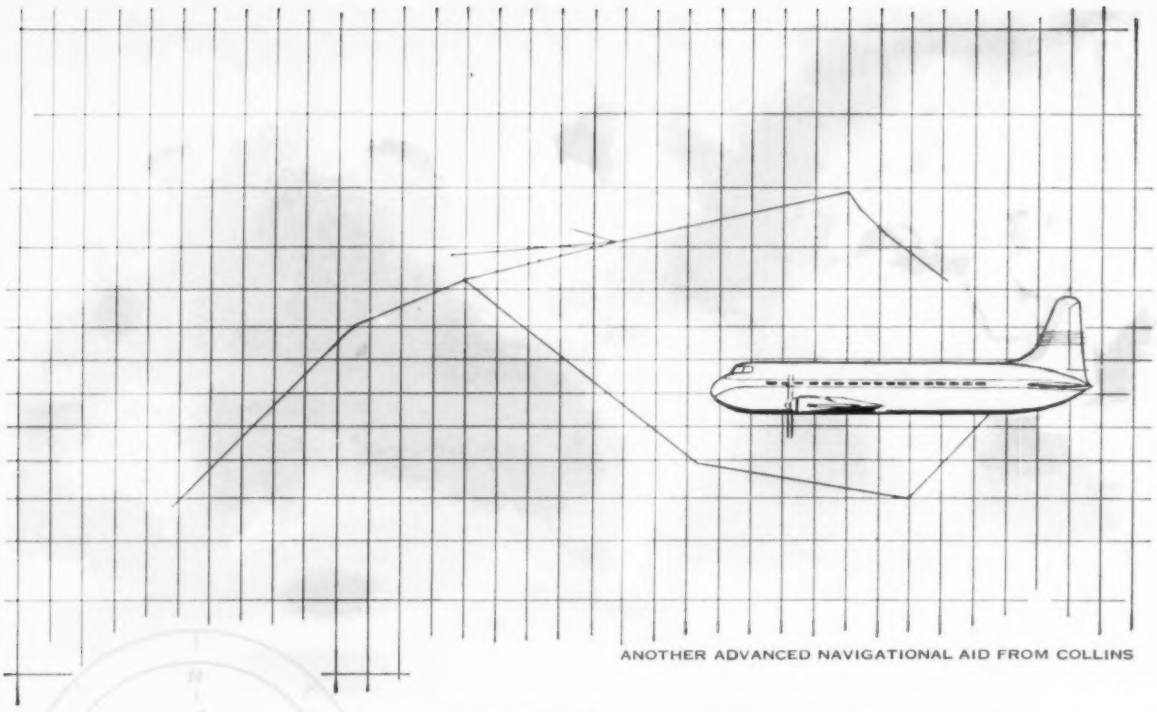
These mounts were selected to isolate the J-69 because they provide the required "softness" for good absorption of vibration and shock—together with self-snubbing action, stability and strength. In fact, the same mounts are noted for exceptional isolation of engine vibration in many well known heavy-duty trucks and busses also.

Remember, when it comes to vibration, MB specialists can help you all the way—with properly engineered products not only for controlling vibration, but also for vibration testing and measuring. Write for more information on Isomode mounts to Dept. 8.

*Reg. U.S. Pat. Off.

the manufacturing company, inc.
1060 State Street, New Haven 11, Conn.

HEADQUARTERS FOR PRODUCTS TO ISOLATE VIBRATION
. . . TO EXCITE IT . . . TO MEASURE IT



ANOTHER ADVANCED NAVIGATIONAL AID FROM COLLINS

New heading stability and accuracy

COLLINS MAGNETIC COMPASS SYSTEM

fulfills all heading source requirements

Collins new Magnetic Compass System, the MC-101, is a gyro-stabilized magnetic compass designed to furnish all airborne navigation instruments the required magnetic heading information.

Aircraft instrument panel simplification is achieved by including the Remote Master Heading Indicator in the Compass Amplifier. Basic heading indication can be presented to the pilot by use of the Collins Course Indicator, the RMI or similar instruments.

Superior D/G operation is insured by the use of a low drift, high inertia gyro.

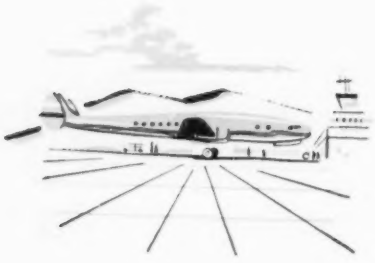
High sensitivity of the gyro correction system to the basically accurate flux detector provides the needed accuracy for modern day aircraft operation.

The pilot has complete control of the various modes of compass operation by the use of a simple three-way toggle switch. He can select automatic or D/G functions, and can manually correct the D/G left or right.

Packaging of the Collins Compass permits easy line replacement without disturbance to instrument panel. The D/G and amplifier mount in the radio rack.

No additional amplifiers are needed. A total of three transmitters in addition to the D/G automatic pilot pickoff provides more than adequate systems output as well as electric isolation between various heading loads.

Magnetic amplifiers are used extensively for maximum reliability. Modular construction in the compass amplifier provides utmost flexibility and servicing convenience.



Write for full information on Collins new Magnetic Compass System.

COLLINS RADIO COMPANY
Cedar Rapids, Iowa

261 Madison Avenue, NEW YORK 16
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New Publications

The ALPA Story is 44-page brochure telling in words and pictures the background, functions and organization of the Air Line Pilots Assn. ALPA's address: 55th St. and Cicero Ave., Chicago 38 . . . . The 1954 edition of **CAA's Statistical Handbook of Civil Aviation** is available from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. for 50 cents. This seventh annual issue contains all available statistics on major aviation activities to Jan. 1, 1954 . . . . New illustrated, breezily written booklet designed for employe distribution tells **how machinery creates jobs,** opportunities and better standard of living. Title is The Adventures of Countersunk J. Lathe, or What the Machine Tool is Doing to Civilization. For sample copy and prices, write to Enterprise Publications, 11 N. Wacker Drive, Chicago 6.

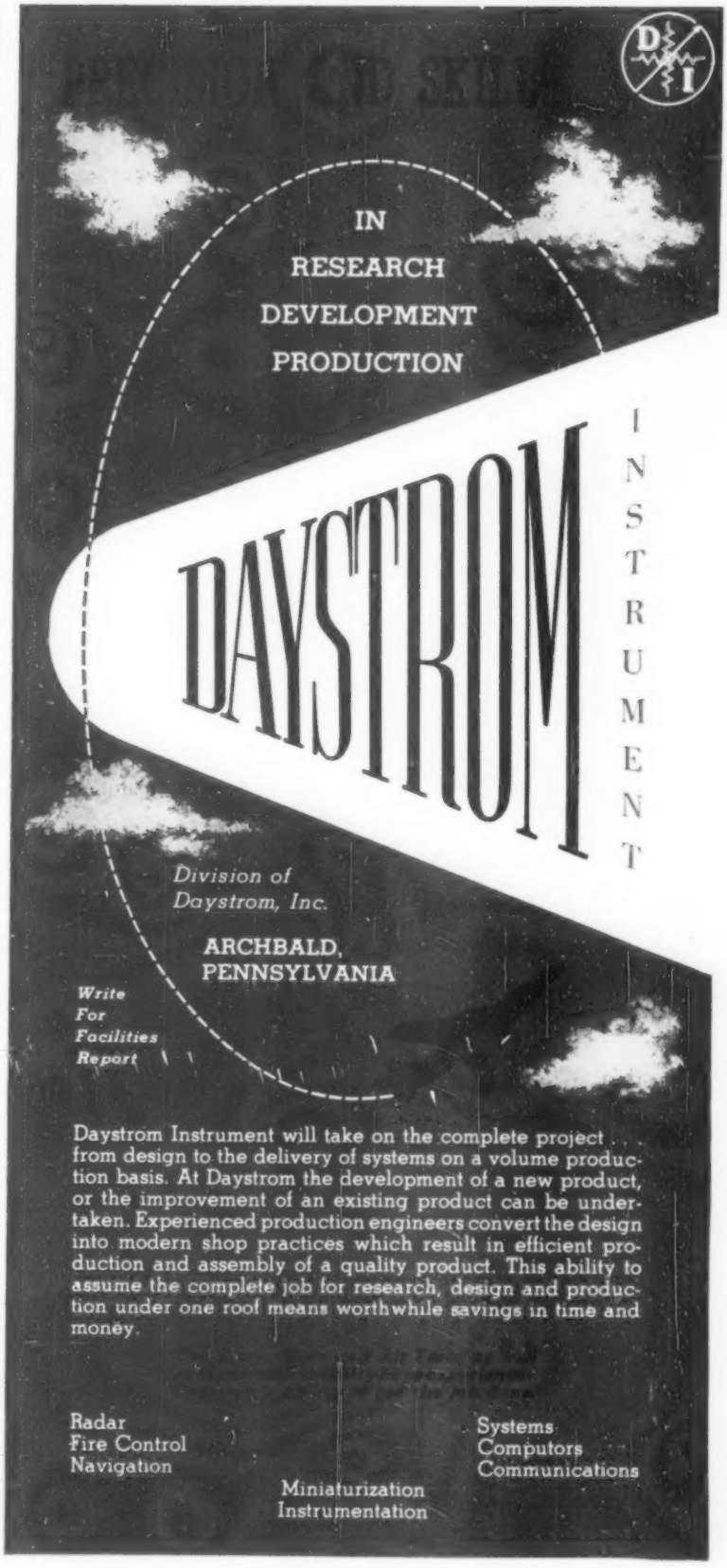
Authoritative 80-page book, entitled **Solder, Its Fundamentals and Usage,** is offered without charge by Kester Solder Co., 3201 Wrightwood Ave., Chicago 39, Ill., Dept. TP. . . . **Aluminum Data Book, 1954 Edition,** issued by Reynolds Metals Co., offers 220 pages of detailed technical information on aluminum. Available free of charge to engineers, designers, etc., who request it on company letterhead; price to others is $1.00. Reynolds Metals Co., desk PR, 2500 South Third St., Louisville 1, Ky. . . . New designation system for **wrought aluminum and its alloys** is given in handy wall chart available from Kaiser Aluminum & Sales, Inc., Industrial Service Div., 1924 Broadway, Oakland 12, Calif.

Company News

Traid Corp. is the new name for four companies that recently consolidated. The companies: Training Aids, Inc., J. E. S. Corp., T. A. Inc., and Training Aids, Inc. Address is Sherman Oaks, Calif. Company is offering illustrated 36-page catalog showing its 16-mm. and 35-mm. highspeed and data-recording cameras.

Lund Aviation, Inc., is newly formed aeronautical sales, service and supply organization, with executive offices at 247 Park Ave., New York, and plant operations at Millville, N. J. President is Edward Lund; vice president is Howard L. Hartman.

U. S. Industries, Inc., is new name of Pressed Steel Car Co., Inc., Box 157, Straford, Conn.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FINANCIAL

Plane Sales Bolster Delta Report

But capital gains will be smaller in the next fiscal year, although operating earnings should show a gain.

Delta Air Lines' recently released 1954 annual report, together with its first-quarter statement for the 1955 fiscal year, shows every indication that the airline has overcome the integration expenses involved in absorbing Chicago & Southern Airlines into its system.

(Delta is one of the two trunk carriers whose fiscal year ends June 30; the other is National Airlines, discussed in AVIATION WEEK Oct. 4, p. 62.)

▶ **Equipment Profit**—The Delta-C&S merger became effective on May 1, 1953. For the fiscal year ended June 30, 1954, Delta reported net income of $1,305,949, or $2.18 per share on 600,000 shares outstanding.

As with National's results, however, the bulk of Delta's profit this past year came from the sale of flight equipment. In specific terms, $1,022,365 of Delta's total reported net profit was realized through the disposition of aircraft. Net capital gains for the 1953 fiscal year were higher, aggregating $2,756,561. Net income from operations (after taxes) amounted to only $283,584 for the 1954 fiscal year. This operating income is after an adjustment of $453,313 to amortize the property acquisition account resulting from the merger.

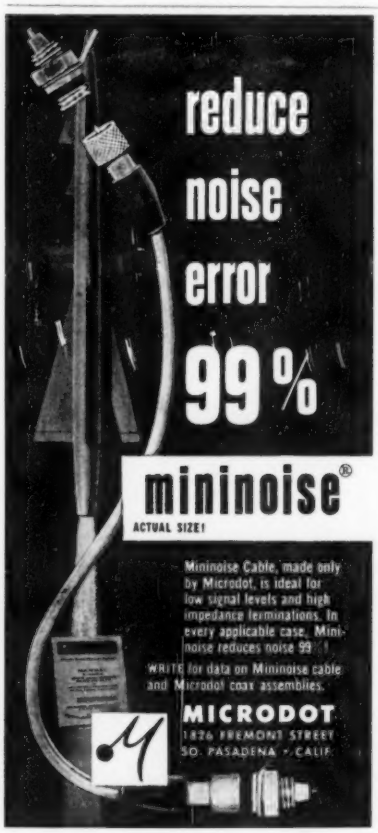
Any comparison with 1953 results is misleading due to the separate operations of the two constituent companies now forming the merged enterprise. It is most interesting to observe, however, that at the time of the merger proceeding, Delta forecast annual operating earnings of better than $7.00 per share for the combined system. (Net operating earnings amounted to only 42 cents per share this past year.)

▶ **Unexpected Hurdles**—Operations this year had to overcome a number of hurdles not previously anticipated. For example, integration of employes of the two companies and settlement payments in keeping with the so-called Burlington labor formula had to be absorbed by operating earnings. This same type of stipulation caused the Slick-Flying Tiger merger to collapse.

Of major significance, too, is the company's uncertain status as to subsidy mail payments. As a result of a Supreme Court decision upholding the Post Office position that certain earnings from domestic operations should offset international mail subsidy payment, the company is in an "open rate" period from May 1, 1953 forward. The case is now before CAB for review.

▶ **Better Quarter**—Results for Delta's three months ended Sept. 30, 1954, the first quarter in its 1955 fiscal year, reveal a much improved trend. Also, this quarter is the first which permits the merged airline to compare results with the like 1953 period on a uniform basis. For this September 1954 quarter, Delta reported net operating income (before various adjustments and taxes) of $632,429, compared to a loss of $40,887 during the same three months in 1953. After these adjustments and tax provisions, the current quarter reveals a net profit of $171,421, contrasted with a net loss of $72,226 for 1953.

The improved results reflect the increase in passenger revenues, up from $10.1 million to $11.9 million, a gain of about 18%. Reported earnings for both periods, of course, are subject to any subsequent mail rate adjustment on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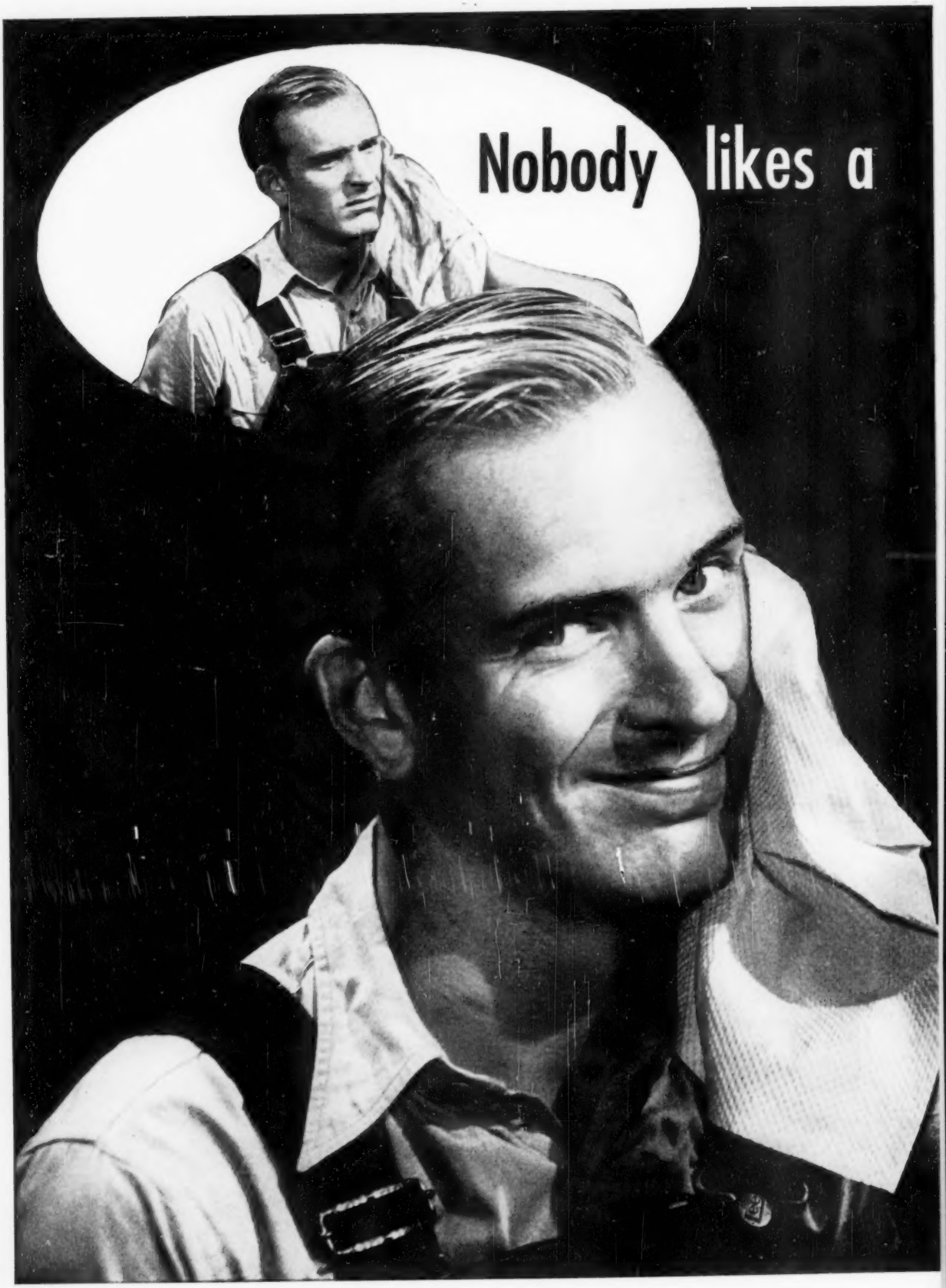
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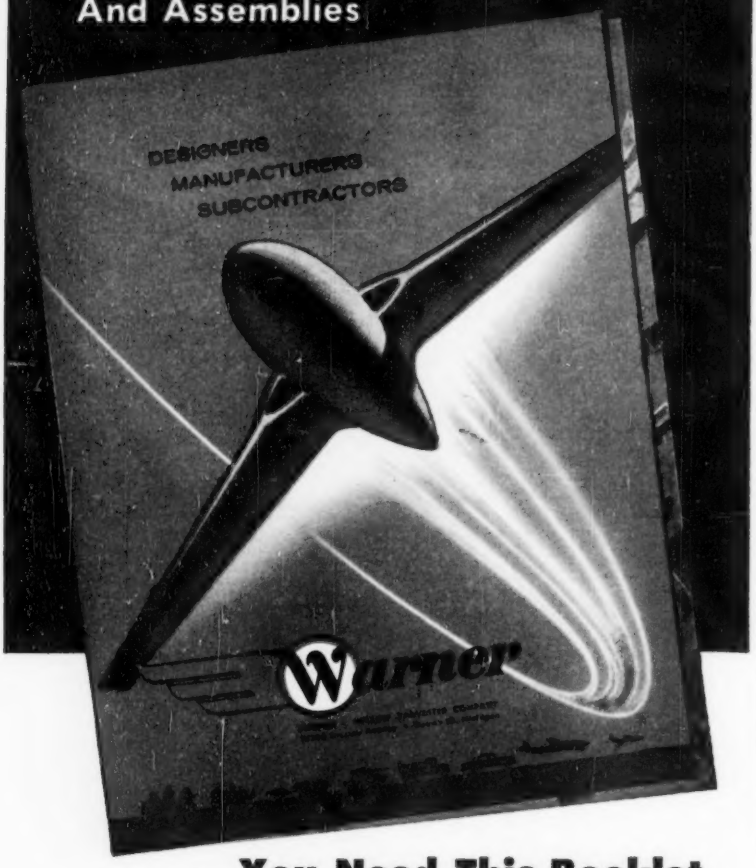

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the international division. CAB reports indicate that the international division showed an operating loss of $262,000 in the current quarter.

At the time of the merger, Delta officials indicated that operating revenues for the combined system would "reasonably be expected to reach the $55 to $60 million a year mark in the latter part of 1954 and 1955." For the fiscal year ended, June 30, 1954, total revenues were $50.3 million, up about $2 million over the preceding year for the Delta and C&S systems combined.

For the quarter ended Sept. 30, 1954, total revenues aggregated $13.2 million, an increase of almost 17% over last year. A continuation of this trend should permit the company to attain its projections by next year as planned.

▶ **Working Capital**—Delta's financial position was able to absorb the expenses incident to the integration and also show improvement. As of June 30, 1954, there were $10,856,600 in 5½% subordinated convertible debentures outstanding. The company also has a credit agreement permitting the borrowing of up to $20 million on unsecured notes at 3½% interest. This loan will be repayable in 16 quarterly installments starting 15 months after the date of each loan. At Sept. 30, 1954, $14 million in such loans were outstanding.

Net working capital, which stood at $8.7 million at June 30, 1954, improved to $89 million three months later. At Sept. 30, 1954, the company was committed to acquire six DC-7s and related spare parts. After applying advances of $2.5 million to the manufacturers, the company will be required to pay about $9.7 million in addition to complete this capital acquisition.

Depreciation should provide a substantial cash throw-off, amounting to $5,275,152 during the 1954 fiscal year and almost $1.5 million in the recent September quarter.

▶ **Equity Position**—Net equity for stockholders reached a new peak of $27.06 per share as of June 30, 1954. Sharp reductions are being effected in the intangible property account capitalization resulting from the merger. This account, reflecting the excess of the fair market value of flight equipment acquired from C&S over the net book value at the time of the merger, May 1, 1953, stood at $2,753,381. On June 30, 1954 it had been reduced to $993,591, and three months later to $928,791. While such charges tend to reduce reported earnings, they also serve as a source of cash throw-offs in the same manner as depreciation.

In keeping with present airline trends, Delta's operating earnings for the 1955 fiscal year are likely to exceed 1954 results. Capital gains, however, from sale of equipment are likely to fall far short of last year. —Selig Altschul

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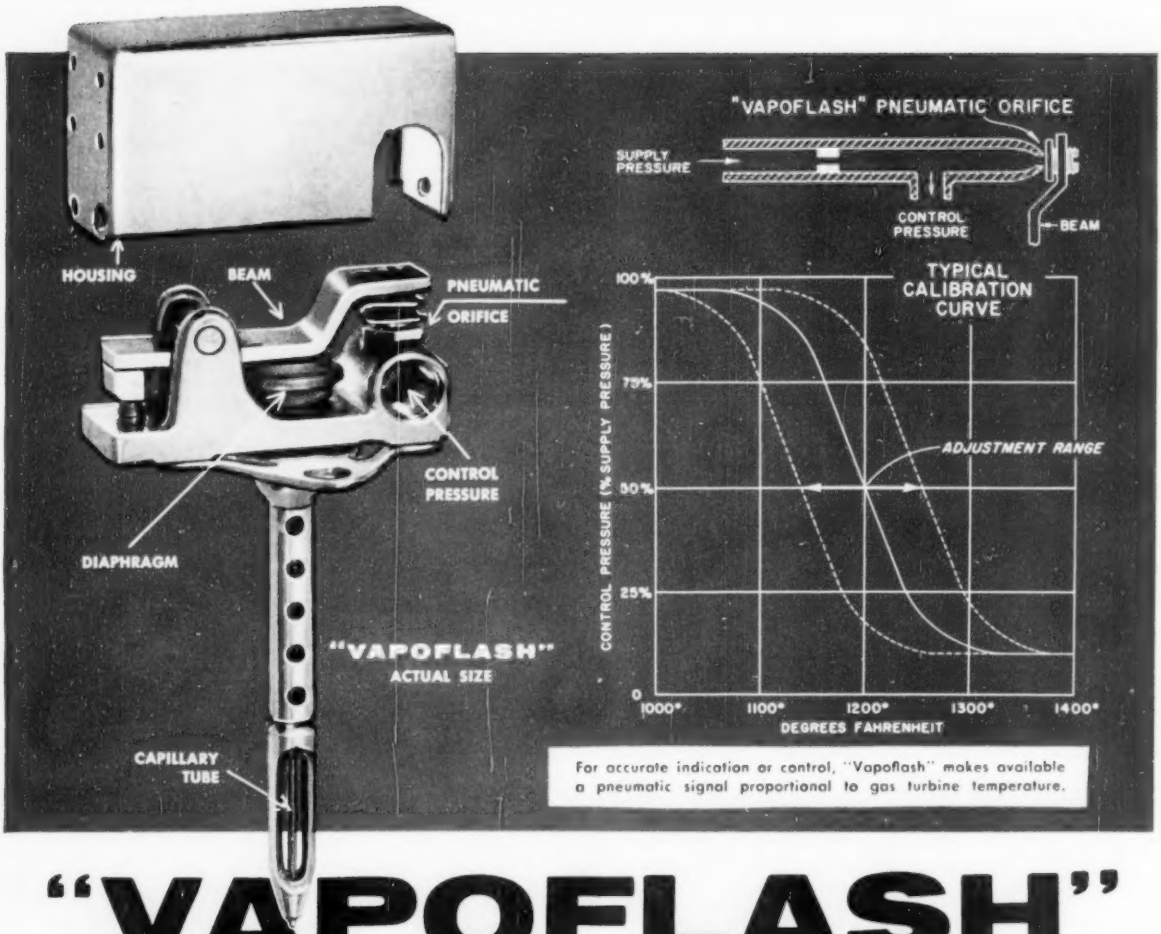

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OVERSEAS SPOTLIGHT

LITHGOW after record-setting flight.

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LONDON

Lt. Cdr. Mike Lithgow, chief test pilot of Vickers-Armstrongs' Supermarine Division, is learning that sometimes you can have more trouble on the ground than when streaking through the sound barrier up in the wild blue yonder.

Britain's new Minister of Supply, Selwyn Lloyd, has ordered an investigation into Lithgow's recently published book, "Mach One." The London Times quotes the ministry as saying that the book contains "certain information in respect of military aircraft in a restricted category." The ministry states that no request had been made for permission to publish the classified information, but since the book was already distributed at home and overseas, "no useful purpose would have been served by seeking to postpone publication.

Lithgow set a world's speed record in September 1953, flying a Swift F.4 at 735.7 mph. in Libya.

Trouble in Scandinavia

STOCKHOLM

The Norwegian airline, South American and Far Eastern Airline (SAFE), is training its sights on the tri-nation airline, Scandinavian Airlines System.

The three governments represented in SAS—Sweden, Denmark and Norway—have made it their "chosen instrument" for foreign service and now have given it priority on internal, domestic routes too.

SAFE had established a line from Scandinavia to the Far East, but its renewal certificate was turned down by the Norwegian government to avoid competition with SAS. SAFE's internal Norwegian line has certain concessions, but the traffic ministers of the three governments have indicated they will not be renewed until SAS has time to

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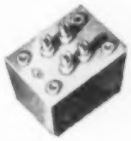

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present a plan for development of domestic traffic.

Shippingham Braathen, founder of SAFE, stated: "When the national authorities in Sweden and Denmark can make the decisions about domestic flying in Norway, things have come to a pretty pass."

Germans Revive Research

Two major aeronautical research centers are being established by West German scientists.

Already organized is the Deutsche Versuchanstalt fur Luftfahrt at Essen-Muhlheim Airport under the leadership of Prof. Dok. August Wilhelm Quick, also associated with the University of Aachen.

Being organized at Braunschweig is the Deutsche Vorschung fur Luftfahrt, to be headed by Prof. Otto Lutz. These men also are acting as technical advisors for newly organized Lufthansa airline.

A source close to these new research centers has told AVIATION WEEK that supersonic military aircraft projects are high on their pending agendas and that the Germans hope to be major suppliers to NATO in 1958. It is reported also that Prof. Kurt Tank, Focke-Wulf's top designer during World War II, has returned from Argentina and is expected to join DVL-Essen-Muhlheim.

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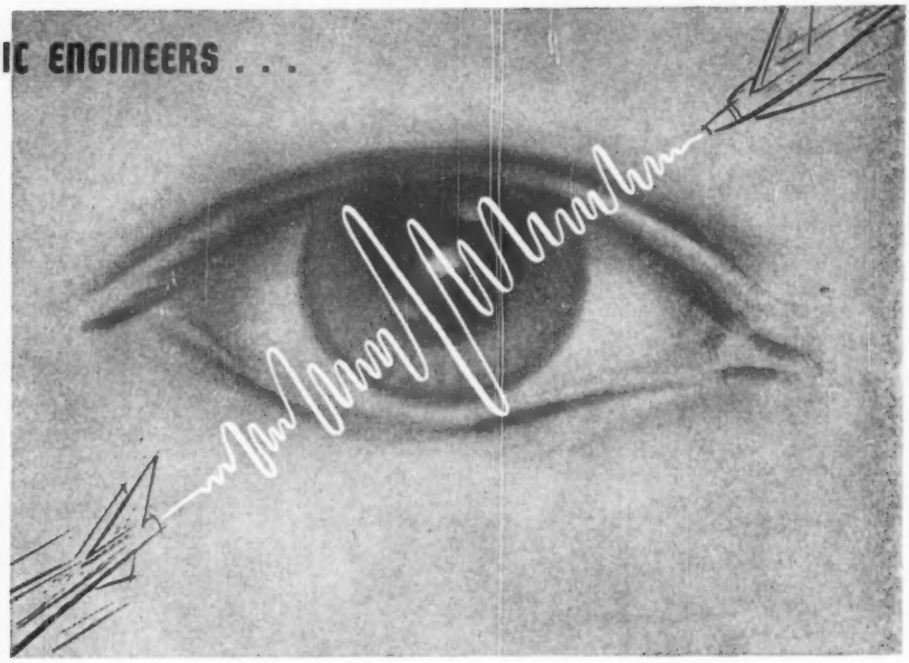

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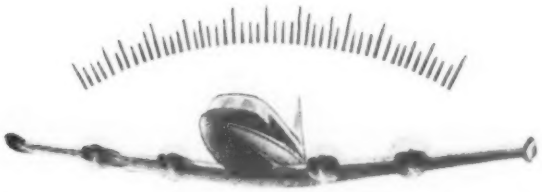

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ATA President Claims:

Airlines Caught in Fare-Cost Squeeze

- **Profits suffer because fares have stayed down while expenses have risen, Johnson tells security analysts.**
- **Air transport needs investor confidence for support of jet, turboprop, copter, freighter and airways plans.**

By Frank Shea, Jr.

Chief problem of the air transport industry today and one from which virtually all others stem is how to attain the wider profit margin warranted by its ever-increasing volume of business.

Speaking before the New York Society of Security Analysts last week, Air Transport Assn. president Earl D. Johnson said a big reason for this problem is the fact that despite a strong upward spiral of costs, airlines have been operating under a "fixed, even a declining average fare."

This upward spiral applies to both the prices of equipment and facilities the airlines buy and the wages they have to pay their employes, Johnson noted. He pointed to the steady upward rise of consumer prices over the past 15 years, with the exception of the price control period during World War II.

▶ **Cost-Fare Contrast**—"The significant thing is that neither the consumer price level nor the average airline paycheck has dipped since 1938," he said. "Today, against a 1938 base index of 100, our net fare stands at 103.5, consumer prices at 192.2 and the average airline paycheck at 228.0.

"How have we been able to avoid major financial difficulties with such a vivid contrast between rising operating costs and static fares?" Johnson asked. He gave four reasons:

- Substantial and continuous growth in volume.
- Technological improvements in both aircraft and related equipment.
- Increased productivity of the individual employe.
- "Truly superb" efforts of management.

He also gave a fifth reason: "The degree of past, present and prospective understanding of the Civil Aeronautics Board in the administration of the Civil Aeronautics Act, and of the executive and legislative branches of the government."

▶ **Major Programs**—The air transport industry, with its dynamic growth trend and continuing stream of technological improvements, should remain for years an industry requiring huge amounts of new capital, the ATA chief stated.

"Looking ahead, say for the next 10 years, and I doubt that anyone can put a much more exact timetable on these events than 10 years, it is reasonable to expect that we as an industry will engage in five major capital expenditure programs." He listed the following:

- Substantial replacement of the piston-powered airliners with turboprop transports.
- Introduction of a specially designed cargo fleet or a major conversion of the existing fleet to cargo types.
- The addition to and, to a limited extent, replacement of existing fleets with helicopters.
- Addition of a substantial fleet of jet aircraft.
- Major capital expenditures for ground, flight line and airways equipment and facilities.

Johnson declined to try and give an exact dollar figure for the total of these capital demands but said it certainly would not be less than $1.5 billion in the next decade for domestic trunklines alone. He added some studies indicate the total could hit $2.75 billion.

First Transpolar

COPENHAGEN—Scandinavian Airlines System inaugurated scheduled service over its transpolar Los Angeles-Copenhagen route last week, cutting 1,000 mi. off flights between the U. S. West Coast and Denmark.

The first of two Douglas DC-6Bs to complete the 5,800 mi. over-the-pole route landed here 23 hr. 53 min. after it took off from Los Angeles, with brief stops at Winnipeg, Canada, and Bluie West 8 in Greenland. The second DC-6B, Copenhagen to Los Angeles, took 27 hr.

As the eastbound SAS transport was between Greenland and Denmark, it passed the westbound sister airliner en route to California. —WJC

▶ **Investor Source**—"It is not at all unlikely that within the next five years we shall see individual undertaking of a single piece of financing totaling $100 million," Johnson said. "Much of this required capital will come from depreciation reserves. Another substantial segment will come from retained earnings.

"But a very large part of it, of necessity, will come in the form of borrowed funds. This means looking to the public and the institutional investor as a source for funds.

"Management's recognition of both the magnitude of its financial problems and the understanding of its capital requirements has been, of course, a necessary prerequisite to achieving success in obtaining those funds. . . .

"However, there is a limit to what management can do. There is a limit to the contribution that investors can be called upon to make in the way of deferred or even foregone dividends; there is a limit to the improvements that can be achieved through more advanced equipment; there must even be an eventual limit to our growth. . . .

"We must look to government for understanding regulations and administration," he emphasized.

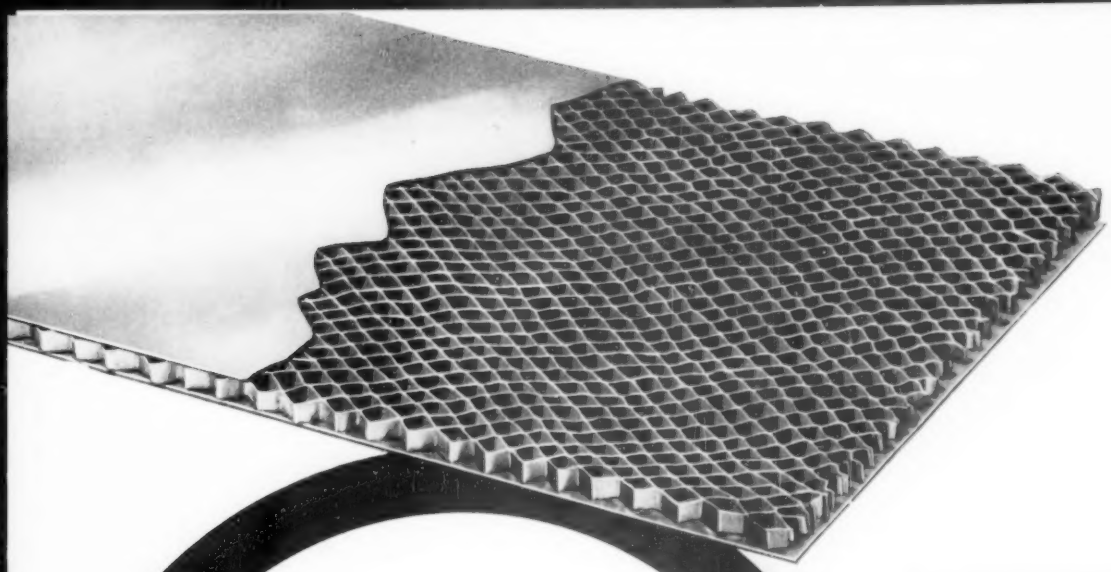
▶ **Financial Problems**—Pointing to a growing spirit of cooperation between government agencies and the industry, Johnson cited ATA's appearance before CAB last year to explain the industry's economic and financial problems.

He said a similar appearance will be made this week, with ATA emphasizing:

- Rising costs with static fares.
- The need for forward-looking regulations that will allow the industry to stay financially sound and thereby continue to support 110,000 employes.
- The industry's continuing need for large amounts of new capital—"Capital which can only be attracted if it is allowed to earn an adequate return and, of course, this includes the need for so regulating the industry as to allow management to pay reasonable dividends.

"In short," said Johnson, "ATA seeks regulation which will allow management to exploit all the potentials inherent in this dynamically expanding industry."

▶ **Consolidating Gains**—He told the group there is in the making a regulatory climate or environment, and a legislative one that, if continued, will



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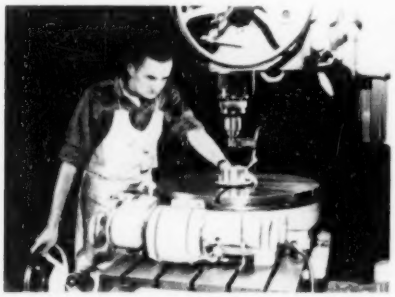
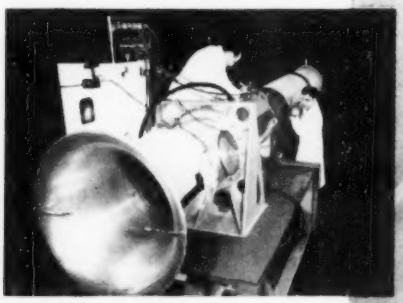
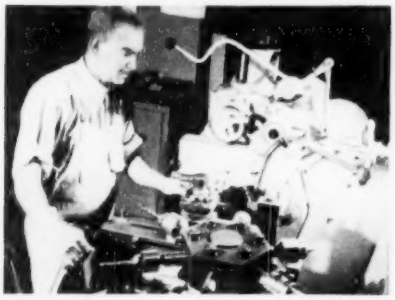


Efficient production design of the J44 Turbojet requires only standard tooling—means economical production.



In actual service the J44 has demonstrated performance far in excess of original engineered service life.



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allow management to consolidate the gains of recent years and build a stable earnings base—an essential factor in achieving a sound investment rating for the industry.

"The over-optimism of the immediate postwar period, followed by the equally severe pessimism of the past few years, have not been and are not in consonance with the facts regarding opportunities in airline investment. These emotional extremes have not been realistic in terms of earning power, increasing net worth and the inherent essentiality of the air transport business. In short, they did not reflect basic values.

"In my opinion," Johnson concluded, "those people who make an objective study of the present position of the air transport industry, the large and continuing opportunities for financing, the current position of airline securities, the future possibilities and relate these factors to overall investment and financing opportunities in the market place—they, in the long run, will be well rewarded for their efforts."

FTL Official Proposes 'Steerage' Air Travel

"Steerage" class air travel, similar to that offered by cargo shipping lines, was proposed by Lewis C. Burwell, vice president of Flying Tiger Line, before American University's eighth Air Transportation Institute.

"Even with our expanding economy and all the good things that it brings, there is always a sub-marginal stratum of society that can't quite make ends meet," he commented. "These people want to travel, sometimes must travel, and always must take the cheapest way. Neither time nor speed compels them—but only price."

► **'Co-Show' Plan**—"Our ocean-going cargo vessels carry 12 passengers," the FTL executive said. "These passengers' convenience is subordinated to the cargo. There is no reason why all-cargo aircraft in the future cannot carry a limited number of 'steerage' class passengers at a very low price on a go-show basis.

"Aunt Minnie may sit at the airport through two or three flights until there is space for her, but she will still beat surface times and she will fly at bus rates. She would represent nothing but net revenue to the carrier and to the entire industry because otherwise she would not have flown."

► **Night Services**—Burwell also anticipated that messages by air "will cut deeply" into telegraph and cable services. "Why should I send a night letter if I can have a fully worded message with six copies in Chicago at the same time tomorrow morning?" he asked.

He advocated "liberal discounts" for night travel on the scheduled passenger lines to increase plane utilization and estimated that these carriers "will, as they have in the past, devote their major energy to the carriage of people and their luggage."

► **10-Year Outlook**—Over the next 10 years, Burwell predicted a doubling of airline passenger business, a 700% increase in air cargo ton mileage and a 1,200% climb in passenger and cargo charter services.

His 1964 outlook for competitive types of transport:

- "Over-the-road commercial transport will decrease until our inevitable super highway system is completed—which will be about 1964. By then, trucking companies will operate tugs and trailer beds only. Pre-loaded containers will either be owned by the shipper or leased by him from the container manufacturer.
- "The rail passenger business will go the way of the Long Island ferry except for the commuting trains. These will increase as more people move to the country but continue to work in the city. Rail freight will not decline.
- "Sea travel will disappear except for pleasure. The steamship companies in 1964 will sell entertainment. Transportation will be incidental. Ocean cargos will increase."

ACC Tightens Control Over Airport Policy

Air Coordinating Committee has tightened its control over airport policy by reconstructing and strengthening its airport use panel.

All policy pertaining to airports, including federal aid, is to be resolved by the ACC panel before being submitted to the Budget Bureau.

Civil Aeronautics Administrator Fred Lee has been appointed chairman of the panel, which includes representatives of the agencies constituting ACC—Army, Navy, Air Force, Defense and Commerce Departments and Civil Aeronautics Board.

One of the panel's first tasks will be to review the Airport Mobilization plan, originally drawn up in 1951 by the now-defunct National Security Resources Board.

Industry advisors will be consulted by the panel as matters affecting their fields develop. Advisors already designated by ACC: Cole H. Morrow, National Business Aircraft Assn.; Crocker Snow, National Association of State Aviation Officials; Fred Glass, Airport Operators Council; Adm. John H. Towers, Flight Safety Foundation; William Harsfield, American Municipal Assn.; Adm. De Witt Ramsey, Aircraft Industries Assn.; J. B. Hartranft, Aircraft Owners & Pilots Assn.; H. B. Johnston, Air Coach Transport Assn.; Fred Alley, American Association of Airport Executives, and Milton Arnold, Air Transport Assn.

Slick Plans Air-Truck To Compete with Rails

Burbank, Calif.—Slick Airways is planning a nationwide, combination air-truck freight operation which is designed to compete with coast-to-coast rail service.

Directing Slick's new service will be Delos W. Rentzel, recent successor to Earl Slick as company board chairman (AVIATION WEEK Nov. 15, p. 104).

Negotiations already are underway with several trucking companies to establish through-rate contracts for freight going by air and by truck. Under such an arrangement a shipper could send cargo by truck from New York to St. Louis and by air St. Louis-Los Angeles in half the time it would take to ship by rail. Rates would be competitive with rail charges, according to a company spokesman.

Last month Slick and Flying Tiger Line formally abandoned the proposal to merge and decided to continue as independent airfreight carriers.

NWA's First 1049G Super Connie Rolls Out

Lockheed Aircraft Corp.'s first 1049G Super Constellation—and the first of four for Northwest Orient Airlines—is shown shortly after it rolled off the assembly line at Burbank, Calif. NWA will put its new 1049Gs on Pacific routes next spring, enabling it to add more Boeing Stratocruisers and Douglas DC-6Bs to transcontinental service.

Air-Rail Mail Fight Splits CAB

Josh Lee files strong dissent against Board decision setting temporary rate in West Coast experiment.

By Craig Lewis

The bitter air-rail fight over carrying surface mail by air has caused a division within Civil Aeronautics Board, with member Josh Lee filing a strong dissent from the majority decision to set a temporary rate for the West Coast experiment (AVIATION WEEK Nov. 15, p. 105).

Previously, the Board concurred unanimously on temporary rates for airlines flying surface first-class mail on three occasions: the original establishment of temporary rates for the East Coast project; re-establishment of the same rates to Sept. 30, 1955, to continue the experiment, and the setting of rates for airmail on local service carriers.

▶**Confined to Rate**—Showdown on the experiment is expected when CAB opens full proceedings ordered in setting the rate for the extension of the East Coast experiment.

The Board indicated the proceedings will be confined to rate considerations. The railroads, however, contend the experiment is illegal and may seek a court test (AVIATION WEEK Oct. 4, p. 79).

▶**'Tantamount to Denial'**—The Board has recognized the substantial interest of the railroads by favoring their participation in the final rate proceeding.

In his dissent, Lee says: "What the majority fails to recognize, however, is that unless the railroads are allowed to participate now in the temporary rate proceeding, they will not have an opportunity to present their views until after the Board has made its decision because the diversion from the railroads commences as soon as the temporary rate becomes effective.

". . . For all practical purposes the granting of intervention only in the final rate is tantamount to a denial of the railroads' request that they be given an opportunity to be heard before the Board renders a decision."

▶**Two Requirements**—The dissenting opinion supports the use of the temporary rate but points out that CAB had described two requirements when it set up the temporary rate procedure:

- An airline must show that its immediate financial position is critical.
- It must appear that its existing rate is substantially inadequate.

Lee says neither of these two requirements is present in the instant proceeding. "The Board is not now faced with an emergency which requires it to act with such haste that it must disregard the statutory requirements of notice and hearing," he adds.

"Of course the railroads can present their views in the final rate proceeding as the majority suggests, but that is locking the barn door after the horse has been stolen. If, as the majority order states, there will be 'the usually long and tedious process involved in fixing final rates,' irreparable injury could be inflicted upon the railroads."

▶**Question of Authority**—In their petition to CAB, the railroads question both the Board's authority to set a rate on the class of mail involved and the Postmaster General's authority to offer such mail for air carriage. They also question the basis and computation of the rate asked by the Postmaster General.

The Board rejects the first contention, and Lee agrees with the majority that the Civil Aeronautics Act gives CAB power to classify service while fixing mail rates, but he feels the Board's action will prevent it from going into the question of "whether a basic distinction is being maintained between airmail service for mail on which the full six cents has been paid and airmail service on mail carrying three-cent postage."

Lee asks: "Is there a real and valid difference between the handling of 'surface' mail and the handling of regular airmail? If so, what is that difference?" He says the rate of 18.98 cents for surface mail is less than half that paid for regular airmail.

Of the Postmaster General's authority to offer surface mail for air transportation, the majority decision suggests that the courts would be the place to settle the issue if the railroads want to press it. Lee says it would seem that "the Board's responsibility in implementing what may be an illegal act should be examined before and not after the action is taken."

▶**ATA View**—Meanwhile, Stanley Gewirtz, assistant to the president of Air Transport Assn., describes railroad opposition to the experiment as an impediment to transportation progress and says diversion of revenues from the railroads would be fractional.

"We have been accused by the railroads of diverting their revenues to the detriment of their financial help," he says. "Let me note that in 1953 the total first-class mail carried by the railroads equalled two-fifths of 1% of total railroad operating revenues. Or, to put it differently, of the total postal revenues of $345 million, first-class mail totaled only $41 million.

"If the airlines carried all of this mail it would represent an insignificant inroad into a multi-billion-dollar rail industry.

"So far, the first-class-mail experiment has succeeded. That success is very likely the reason for objections from people with a stake in moving the mail by other means. . . . Congress, historically, has a long record of supporting better postal service for the public. If the question is again put to them to stand up and be counted for progress, it is hard to believe that many congressmen would refuse to do so."

Old and New Convair Turboprop Transports Meet

Convair's new YC-131C (left), powered by 3,750-hp. Allison YT56-A-3 turbines, was joined aloft for the first time by the 240, owned by Allison Division of General Motors and powered by Allison T501 (T38) turbines, when the latter visited the Ft. Worth-Dallas area during a demonstration tour. This YC-131C is the second of two Convair 340s converted to turbine power at the company's Ft. Worth Division for USAF development trials in evaluating turboprop power in transports.

New Costa Rica Field To Take Big Airliners

(McGraw-Hill World News)

San Jose, Costa Rica—This capital city's new $3-million Cocos Airport will be opened officially next June, giving international airlines a field large enough for four-engine transports for the first time.

Cocos also will have the first VOR (visual omnirange) to be installed at a commercial airport in South America.

▶ **Largest, Most Complete**—Maj. Mario Facio, Costa Rica's director general of civil aviation, says the new airport will be the largest and most complete in Central America. It will have a 6,600-ft. paved runway that can be extended in the future to 10,000 ft.

Because of this runway and new hangar facilities, Pan American World Airways, KLM Dutch Airlines, TACA International Airlines and Costa Rica's own LACSA are expected to switch to four-engine aircraft on flights into and out of this city next June.

On domestic routes, LACSA will continue to operate twin-engine transports.

▶ **CAA-Approved Shop**—Hangar facilities will include a single installation capable of handling four Lockheed Super Constellations at one time. In addition, the SALA repair shops—the only aviation maintenance facilities in the Central American area approved by Civil Aeronautics Administration—will be moved to Cocos.

Lighting facilities being installed by Westinghouse Electric Corp. will allow 24-hr. operations, compared with 8 hr. or less now at the present inadequate Sabana Airport.

Maj. Facio says Sabana probably will be abandoned once the new airport becomes operational.

The new airport is being financed entirely by the Costa Rican government with no foreign aid involved. The government will own and operate Cocos under the direction of Maj. Facio.

LAA Starts Copter Passenger Service

Los Angeles—Los Angeles Airways is scheduled to begin passenger feeder service this week (Nov. 22) between Los Angeles International Airport and the downtown Long Beach Heliport.

LAA expects to follow this inaugural passenger service with flights to other southern California cities early next year, according to president Clarence Belinn.

Initial flight schedule calls for six roundtrips daily, each requiring 12-min. for the 17-mi.-plus hop. Flights are linked with peak arrivals and departures of longhaul airlines operating out of L.A. International (AVIATION WEEK Oct. 25, p. 95). The oneway fare, including tax, has been set at $6.

LAA has established the following fares for its planned extended service: $3.85 oneway, tax included, for service to and from community heliports located at a maximum radius of 10 mi. from L.A. International; $6 for those within a maximum of 20 mi.; $7 within 40 mi; $8 within 65 mi.

A fleet of four seven-passenger Sikorsky S-55 helicopters will be used.

Nonskeds Start Drive For Clearing House

Nonscheduled airlines started their drive for a central clearing house to parcel out commercial business at hearings last week before Civil Aeronautics examiner Paul Pfeiffer.

The two nonsked organizations—Independent Military Air Transport Assn. and Air Coach Transport Assn.—have operated exchanges for information on military traffic available to their members.

The pending CAB case will decide whether they are to be able to operate such an exchange, coordinating the shipper demand with the availability of services, on a commercial basis.

Scheduled airlines are opposed to the operation of the "air exchange" on grounds that it would create centralized control tantamount to operation of a single nonsked line.

Unless IMATA and ACTA agree to merge, there is the prospect of competitive exchanges for the two groups.

Riddle Asks Speed Up On Cargo Certificate

Riddle Airlines has asked Civil Aeronautics Board to sever the north-south phase of the airfreight renewal case from the consolidated proceeding to speed action on Riddle's application for certification as a cargo carrier.

Riddle says the north-south phase of the case will be ready for decision shortly, while the east-west may be delayed for some time—especially in view of the aborted merger of Slick Airways and Flying Tiger Line.

The petition cites the Air Coordinating Committee's civil air policy and the testimony of various shippers in support of its contention that there is an immediate need for regular, dependable airfreight service between north and south.

Riddle's application in the proceeding is "neither necessarily related to, nor dependent upon, any other application," the company says.

RTCA Proposes VHF Field Light Trigger

Operation of field lights by means of coded VHF transmissions from aircraft to permit night landings at unattended airports is recommended by the Radio Technical Commission for Aeronautics.

The VHF system would use the frequencies of 121.7 mc and 121.9 mc for all aircraft and, in addition, 122.8 mc for private aircraft. Recommended utilization of the 121.7 and 121.9 frequencies is in addition to their present use in ground-to-ground utility communication. The 122.8 frequency now is used for a two-way communication service available only to private aircraft.

▶ **Code System**—The recommended system consists of five codes produced by pressing and releasing the microphone button of the aircraft VHF transmitter.

The decoder at the field will accept only one of the codes to prevent activation of more than one lighting system when fields are located close together.

The code signals also prevent turning on lights when the frequency is being used for communication.

▶ **20-Year Program**—Numerous systems for the operation of field lights from aircraft have been evaluated in the last 20 years.

The audio and radio systems were used most generally. The audio system consisted of a microphone on the ground that picked up the sound of an aircraft engine and propeller.

The radio system used a ground receiver that picked up high-frequency transmissions, usually on 3105 kc.

▶ **Disadvantages**—Both systems had serious limitation under adverse conditions. The audio system required a sensitivity low enough to prevent actuation by ground noises, thunder and rain sounds or large aircraft passing overhead at cruising altitudes. But this made it necessary for small aircraft to pass directly over the field at low altitude with full power.

The high-frequency radio system was not satisfactory because of electrostatic interference produced by lightning and other atmospheric disturbances that sometimes caused continuous operation of the lights. VHF minimizes the disadvantages of HF.

▶ **ATA Request**—The VHF band tests were made last year by Bonanza Air Lines, and their success prompted a request from Air Transport Assn. to RCTA for an overall study of the control of ground lights from aircraft.

RCTA has asked Federal Communications Commission to issue rules required to use the three frequencies and recommended that Civil Aeronautics Administration select the receiving frequencies, assign codes and publish the information in the Airman's Guide.

CAB ORDERS

Nov. 4-10

GRANTED:

Flying Tiger Line's application for an exemption authorizing a passenger flight from Athens, Greece, to New York via Munich, Germany, on or about Nov. 16, 1954. An application to make flights from Munich to New York Nov. 9 and Nov. 30 is denied.

Riddle Airlines a temporary exemption for six months to operate among 11 Florida points and New York, carrying perishables and animals.

United Air Lines' petition for leave to intervene in the commercial charter resolutions case.

DISMISSED:

American Airlines' petition for clarification and exercise of jurisdiction in the Air-coach Transport Assn. and Independent Military Air Transport Assn. agreements case.

DENIED:

Pan American World Airways pilots' petition to reopen the record in the reopened New York-Balboa through service proceeding.

APPROVED:

Intercompany agreements involving Pioneer Airlines and Trans-Texas Airways, American and Eastern Air Lines, and various other carriers.

ORDERED:

Southwest Airways' mail rates, proposed in a showcause order of Sept. 28, 1954, to be finalized. Bonanza Air Lines' petition to intervene is denied.

Exemption applications of manufacturers and wholesalers associations of San Francisco and California Apparel Shippers Assn., deferred until a decision is reached in Docket 5947 et al, involving an investigation of indirect air carriers of property and of the renewal and/or amendment of Part 296 of the economic regulations.

Domestic and international airlines to cancel from their tariffs by Jan. 1 all rules, regulations or provisions stating any limitation on, or condition relating to, carrier liability for personal injury or death.

SHORTLINES

► **Air France** has installed a new very-high-frequency transmitter in Mexico. The VHF equipment bridges the communications gap between the Gulf of Mexico and Mexico City, is located atop Real del Monte at 8,030-ft. altitude . . . The airline has bettered its speed record between New York and Mexico City, flying the 2,160-mi. route in 6 hr. 15 min., 14 min. under the old mark.

► **Air Line Pilots Assn.** and New York Airways have signed the first pilot-helicopter airline agreement in ALPA's history. The entire pact is retroactive to Oct. 1, 1953, and will run to Apr. 1, 1955. Clarence N. Sayen, ALPA president, says pay scales and working conditions specified are essentially those developed in contracts for fixed-wing transport pilots, with certain modifications to meet the operating differences of the copter.

► **American Airlines** flew 6,138,000 ton-miles of freight in October, claimed as an industry record.

► **Air Transport Assn.** recorded $42,434,936.26 of interline business transacted through the airlines clearing house in September 1954, up 13.96% over September 1953. . . . Reports U.S. domestic scheduled airlines flew 19,972,647,000 passenger-miles during the 12-month period ended Oct. 31.

► **National, Delta-C&S and American Airlines** will start an interchange coach service Los Angeles to Miami Nov. 29. The service will supplement similar first-class flights operated for two years. The Los Angeles-Miami coach fare: $114.70 one way.

► **North Central Airlines** is retaining summer commuter schedules between the North and metropolitan areas to the South year-round, will increase seating capacity in its DC-3s from 21 to 25 passengers with provision for two-abreast seating on both sides of the aisle.

► **Pioneer Air Lines** carried 13,905 revenue passengers in September, up 31% over last year. Load factor for the first nine months of 1954 was 50.86, compared with 41.97 for the same period of 1953. . . . Carrier reports passenger traffic increased 31% in October over a year ago, with 15,424 passengers flown 4,020,620 passenger-miles for a load factor of 51.07%.

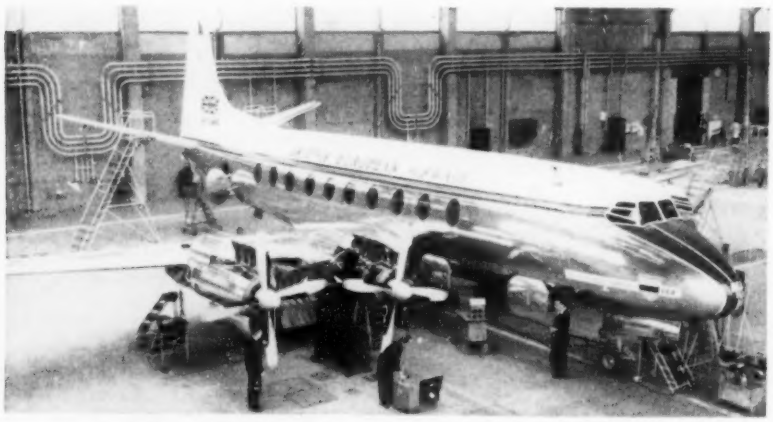
► **Seaboard & Western Airlines** reports freight traffic up 151% in the January-September period of this year over the first three quarters of 1953. Third quarter traffic was 2,845,626 ton-miles, representing an increase of 188.5% over 1953.

► **Southern Airways** set a new company passenger record in October with 13,000 passengers flown 2,140,000 passenger-miles. Traffic increased 6.1% over the previous high of last July and 29.8% over passengers carried during October 1953.

► **Southwest Airways'** Martin 2-0-2s averaged a load factor of 65% for the third quarter of this year, with an average density of 23.4 persons. Average load factor for the first nine months was 60%. John H. Connelly, SWA's president, reports the Martin liners' commercial revenue for the nine months "was $1.42 per plane mile flown, which sum exceeds our published Martin charter rate."

► **Trans World Airlines** has bought 20 airborne engine ignition analyzers for its new fleet of Lockheed 1049G Super Constellations, expected to be delivered early next year.

► **United Air Lines** had its best October in history, logging 315,304,000 passenger-miles and 3,299,000 cargo ton-miles. Passenger mileage was up 29% and cargo mileage increased 24% over October 1953. . . . Carrier has installed a C-band radar unit on the roof of its Denver operating base to gage its use in the prediction of icing conditions aloft.



BEA Adds 21st Viscount to Fleet

British European Airways' 21st turboprop Vickers Viscount transport undergoes an inspection check at the airline's London Airport maintenance base prior to being placed in service. The photo points up how the engine cowlings hinge open for inspection.

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IATA's New Plan

This column on several occasions has commented on the excellent reports of the International Air Transport Assn. Flight Technical Group. IATA recently saw fit to reorganize in a fashion that may very well put an end to this valuable work. Such a loss to the air world seems great enough to warrant more comment.

Briefly, the new plan puts IATA functions on a regional, instead of worldwide basis. Committees will now study more specific cases rather than devoting themselves to general airline matters. It might be said that the switch has been made from longrange, basic industrial research to trouble shooting.

▶**Good and Bad**—There are two ways to view this move—good and not so good. It will be good in that the high-powered brains will now be turned loose on immediate problems; not so good in that aviation is left devoid of an operational "institute for advanced study"—if I may borrow the title.

This may seem like a low blow to various and sundry societies, institutes, committees and flying clubs. Not at all. Obviously, no other group has such a primary interest in airline operations, and nobody delves into these matters with anywhere near the depth of practical common sense that the Flight Tech people did.

▶**Local Tangle**—Another important difference was that the IATA group pooled the world's information, and then ideas and methods were developed by these individuals working together. This is an entirely different process than existing mainly for the dissemination of information. In other words, they were creative.

IATA's purpose, as I see it, is to resolve problems common to all airlines and formulate worldwide policies. This is hardly a regional task. Moreover, regardless of organization, these same people inevitably will tangle with local matters, simply because escape from them is impossible.

▶**Brought Results**—Many fine things resulted from the old setup: approach lights, for instance. After some 20 years of haggling, accord was reached—and not because of politics either—by the very real process of objective discussion and a sincere desire to find the best standard.

But let us not stop here. Similar effort is desperately needed on the rest of the landing system—runway lighting, overrun area, highspeed turnoffs, etc. Other things also must keep pace—methods of flying, pilot training, instrument approaches, instrumentation. All phases of aviation need a sound thinking group to insure against stagnation.

▶**Correct Philosophy**—The significance of this type of get-together was shown recently when a group of British operations people deemed international tete-a-tete important enough to pay a visit to the U.S. to compare notes and learn the latest poop. And who besides IATA can carry on such discussions?

The necessity for developing sound operational fundamentals as a prerequisite to other things has long been a theme song in this space. Be it the flight characteristics of aircraft, the equipment they carry, use of such equipment, ground aids or what have you, all are tied to true, correct philosophy.

Presumably IATA had good reason to reorganize. Economics no doubt had something to do with it. Whatever the reason, it would be well for those who support IATA to reconsider and see if, in the long run, the new scheme will be the most beneficial. It seems evident that the world needs at least one international operations gathering like the old Flight Technical Group.

AVIATION CALENDAR

Nov. 29-Dec. 3—American Society of Mechanical Engineers, Aviation Division annual meeting and sixth Air Cargo and Air Logistics Program, Hotel Statler, New York.

Nov. 30-Dec. 3—American Rocket Society, ninth annual meeting, Hotel McAlpin, New York.

Dec. 16—Air Force Assn., air logistics conference, Andrews AFB, Camp Springs, Md.

Dec. 17—Wright Day Dinner, Statler Hotel, Washington, D. C.

Dec. 17—Institute of the Aeronautical Sciences, 18th Wright Brothers Lecture, U. S. Chamber of Commerce Building, Washington, D. C.; to be repeated Dec. 20 in Los Angeles and Dec. 22 in Cleveland. Lecturer: Bo Lundberg, director of Sweden's Aeronautical Research Institute.

Dec. 28-29—National Science Foundation, fourth Conference on Scientific Manpower, Berkeley, Calif.

Jan. 19-23—Miami International Aerorama, Miami (Fla.) International Airport.

Jan. 24-27—American Meteorological Society, 135th national meeting, New York.

Jan. 24-27—Plant Maintenance & Engineering Show and three-day conference. International Amphitheatre, Chicago.

Jan. 24-28—Institute of the Aeronautical Sciences, 23rd annual meeting and Honors Night Dinner, Hotel Astor, New York.

Jan. 27-28—Southern California Meter Assn., fourth annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif.

Feb. 8-10—Society of the Plastics Industry, 10th annual Reinforced Plastics Division Conference, Hotel Statler, Los Angeles.

Feb. 20-22—Institute of Surplus Dealers, trade show and convention, 212th AAA Armory, New York.

Mar. 11—Institute of the Aeronautical Sciences, National Flight Propulsion Meeting (restricted), Hotel Carter, Cleveland.

Mar. 14-17—American Society of Tool Engineers, 1955 annual meeting, Shrine Auditorium and Exposition Hall, Los Angeles.

Mar. 28-Apr. 1—American Society for Metals, ninth Western Metal Exposition and Congress, Pan Pacific Auditorium and Ambassador Hotel, Los Angeles.

Mar. 31-Apr. 1—Symposium on Boundary Layer Effects in Aerodynamics, Britain's National Physical Laboratory, Teddington, England.

Apr. 6-10—World Plastics Fair & Trade Exposition, National Guard Armory, Exposition Park, Los Angeles.

Apr. 18-21—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aeronautic Production Forum and Aircraft Engineering Display, Hotel Statler and McAlpin Hotel, New York.

Apr. 24-28—Airport Operators Council, 1955 convention, Olympic Hotel, Seattle.

Apr. 29—Institute of Navigation, eastern regional meeting, Friendship International Airport, Baltimore.

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AVIATION WEEK—NOVEMBER 22, 1954

ACME ELECTRIC CORPORATION 81
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Agency—The McCarty Company
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Agency—The Fred M. Randall Company
AIRCRAFT POROUS MEDIA, INC. 40
Agency—Ciangio Advertising, Inc.
AIRWORK CORPORATION 54
Agency—Geare-Marston Adv.
ALL AMERICAN ENGINEERING CO. 64
Agency—Gaynor & Co., Inc.
AMERICAN ELECTRIC MOTORS, DIVISION OF AMERICAN ELECTRONICS, INC 62
Agency—Clyde D. Graham Adv.
AMERICAN SEATING COMPANY 44
Agency—Roche, William & Cleary, Inc.
ARROWHEAD RUBBER CO 69
Agency—Dan Ebberts Adv. Service

CESSNA AIRCRAFT COMPANY 47
Agency—Gardner Advertising Co.
CHANCE VOUGHT AIRCRAFT, INC. 11
Agency—Lennen & Newell, Inc.
CLIFTON PRECISION PRODUCTS CO., INC. 68
Agency—Ivey Advertising Company
COLLINS RADIO COMPANY 72
Agency—W. D. Lyon Co., Inc.
CONSOLIDATED DIESEL ELECTRIC CORP. 75
Agency—Woodward & Byron, Inc.
CONSOLIDATED VULTEE AIRCRAFT CORP. ..... Front Cover
Agency—Buchanan & Co., Inc.
CURTISS WRIGHT CORP 60
Agency—Burke Dowling Adams, Inc.
CUTLER HAMMER, INC. 37
Agency—Kirkgasser-Drew Adv.

DAYSTROM INSTRUMENT DIV., DAYSTROM, INC. 73
Agency—Morse Advertising Agency
deHAVILLAND AIRCRAFT OF CANADA LTD., THE 70
Agency—Paul Taylor-Phelan, Ltd.
DOW CORNING CORPORATION 87
Agency—Wagnitz Advertising, Inc.

ECLIPSE-PIONEER DIV., BENDIX AVIATION CORP. 12
Agency—MacManus, John & Adams, Inc.
EDISON, INC., THOMAS A. (INSTRUMENT DIV.) 32
Agency—Gaynor & Co., Inc.
EDO CORPORATION 97
Agency—Davis, Parsons & Strohmeier, Inc.
ELASTIC STOP NUT CORP. OF AMERICA ..... 4th Cover
Agency—G. M. Basford Company

FAIRCHILD ENGINE & AIRPLANE CORP. 90
Agency—Gaynor & Company, Inc.
FEDERAL TELEPHONE & RADIO CORP. 63
Agency—J. M. Mathes, Inc.
FORD INSTRUMENT CO., DIV. OF THE SPERRY CORP. 48
Agency—G. M. Basford Company

GENERAL ELECTRIC COMPANY 41, 42, 50, 51
Agency—G. M. Basford Company
GILFILLAN BROTHERS 22
Agency—Erwin, Wasey & Co., Ltd.
GLADDEN PRODUCTS CORP. 24
Agency—Walter C. Dawson Co.
GOODYEAR AIRCRAFT CORP. 25
Agency—Kudner Agency, Inc.

HELI-COIL CORPORATION 31
Agency—O. S. Tyson & Company, Inc.
HOLLEY CARBURETOR CO. ..... 2nd Cover
Agency—Holden-Chapin-Larue, Inc.
HOUDAILLE-HERSHEY CORP. 82
Agency—Melvin F. Hall

INTERNATIONAL NICKEL CO., INC., THE 43
Agency—Marschalk & Pratt Co., Inc.

JACK & HEINTZ, INC. 45
Agency—Fuller & Smith & Ross, Inc.
JOHNS-MANVILLE PRODUCTS 26
Agency—J. Walter Thompson Co.

KEN COOK COMPANY 81
KIDDE & CO., INC., WALTER 3
Agency—Cunningham & Walsh, Inc.

LOCKHEED AIRCRAFT CORP. 55
Agency—Foote, Cone & Belding
LOCKHEED AIRCRAFT CORP. 95
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LORD MANUFACTURING COMPANY 38
Agency—Davies & McKinney Adv.

MANNING, MAXWELL & MOORE, INC. 80
Agency—Fuller & Smith & Ross, Inc.
M B MFG. CO., INC. THE 71
Agency—Richard A. Co., Inc.
MICRODOT DIV., FELTS CORP. 74
Agency—Hicks & Greist, Inc.
MONOGRAM MFG. CO., A DIV. OF LEWIS & KAUFMAN LTD. 8
Agency—Taggart & Young Adv.

OLIVER CORP. THE (AIRCRAFT DIV.) 27
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RHEEM MFG. COMPANY, GOVT. PRODUCTS DIV. 21
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SAGINAW STEERING GEAR DIV., GENERAL MOTORS CORP. 66, 67
Agency—Price, Tanner & Wilcox, Inc.
SCINTILLA MAGNETO DIV., BENDIX AVIATION CORP. 33
Agency—MacManus, John & Adams, Inc.
SCOTT PAPER COMPANY 76, 77
Agency—J. Walter Thompson Co.
SEARCHLIGHT SECTION 82, 83, 84, 85, 86, 87
SIMMONDS AEROCESSORIES, INC. 54
Agency—Burke Dowling Adams, Inc.
SOCONY-VACUUM OIL CO., INC. 29
Agency—Compton Advertising, Inc.
SPERRY GYROSCOPE CO., DIV. OF SPERRY CORP. ..... 3rd Cover
Agency—Beach, Yates & Mattoon, Inc.
STILLMAN RUBBER CO. 40
Agency—Lynn-Western, Inc.
STRATOS A DIV. OF FAIRCHILD ENGINE & AIRPLANE CORP. 74
Agency—Gaynor & Company, Inc.
SURFACE COMBUSTION CORP. (JANITROL AIRCRAFT-AUTOMOTIVE DIV.) 34-35
Agency—Odiorne Industrial Adv.

TWIGG INDUSTRIES, INC. 89
Agency—LaGrange & Garrison, Inc.

VULCAN RUBBER PRODUCTS, INC. 58
Agency—Goold & Tierney, Inc.

WARNER DIV., DETROIT HARVESTER CO. 78
Agency—Clark & Bobertz, Inc.
WEBER AIRCRAFT CORP. 65
Agency—Ruthrauff & Ryan, Inc.
WHITTAKER CO., LTD., W. R. 56
Agency—Mogge-Privett, Inc.

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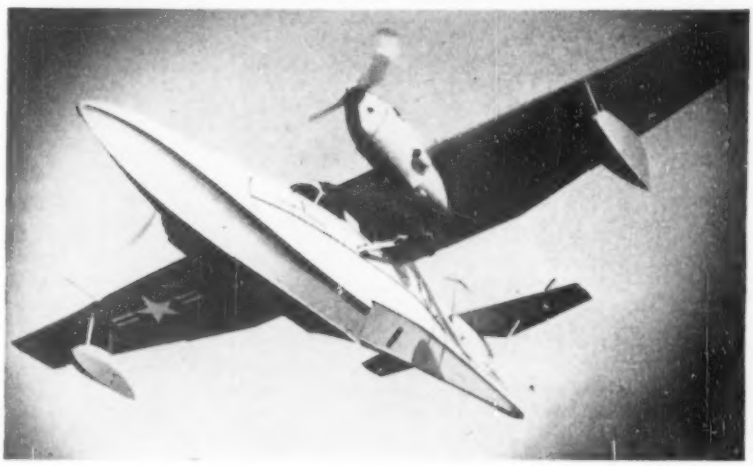
(Classified Advertising)

H. E. Hilty, Mgr.

EMPLOYMENT
Positions Vacant 82-87
Selling Opportunities Offered 84
Positions Wanted 84
Selling Opportunities Wanted 84
SPECIAL SERVICES
To the Industry 85
PLANES—EQUIPMENT
(Used or Surplus New)
For Lease 86
For Sale 86, 87
WANTED
Planes — Equipment 84, 87

NEWS Edo NOTES

28 YEARS OF WATER FLYING DEVELOPMENT



Building better floats for better seaplane performance was the principal reason for the founding of the Edo Corporation some 29 years ago. Since then the development of water flying has remained one of the company's major areas of activity.

Many Edo-pioneered projects are now being put to practical use to help make the future of water-based aircraft extremely bright. For instance, hulls with higher length-beam ratios, such as test flown with this Edo-built hull shown above, give large flying boats better water handling characteristics and faster air speeds. Likewise, development of the hydro-ski, now on trans-sonic fighters, was initiated by Edo in 1947.

Edo

Since 1925

Other projects which will have an equally significant bearing on the future use of water-based aircraft are now underway at Edo. It's led to the saying, "If you want to know anything about flying off water, see Edo."

CORPORATION

COLLEGE POINT, NEW YORK

EDITORIAL

Tackle the Collision Menace

Despite some more general discussions, which have spurred awareness of the menace, the danger of aerial collisions has not dropped off the past year, and some authorities believe the ever-increasing air traffic has brought us face to face with a real emergency.

All of aviation must come to grips with this subject ultimately. Why not now, before grisly headlines shock us into it?

Over the Arctic to Europe

With a daring more economic than physical, Scandinavian Airlines has opened a new air trade route over the top of the world between Los Angeles and Denmark, flying much of the way over arctic land via Winnipeg and Greenland, and slicing from 500 to 1,000 miles off the traditional route via New York, at a comparable reduction in fare. The passenger has no change of planes.

Although direct European air service has been available for years from a few inland points in the United States, SAS opens up the first direct route from the populous and proud West Coast, in southern California.

There are pessimists who are casting doubt on the wisdom or need of such a service. "Twenty-four hours on one plane is a long time," and "most Americans prefer London, Paris or Rome." But there always have been skeptics, and aviation has grown faster than any other transport medium the world has ever known because it dared to try what the pessimists said was impossible or unnecessary.

New air routes are inevitable; some will fail economically. But new routes and new services aviation must always fight for, or we cease our growth and begin to wither.

It will be no black mark for SAS if the route does not pay off immediately. Many new routes in the past have achieved profit only after extended periods of efficient service. The new cutoff, like many others before it, may divert some business from established lines. But more important for aviation, it should create its own business, traffic that no other airline ever carried before.

The important lesson for aviation here is the old one all over again—that we still exercise enterprise and initiative, and dare the unprecedented. It's astonishing how often—if it has the chance—that the public takes to a new and sound idea.

A Piper Flies to Paris

Bill Piper and his loyal associates at Lock Haven, Pa., are basking in the plaudits of aviation people everywhere. So are the workers and executives of Avco's Lycoming Division.

There was a twin-engine Piper Apache, with Lycoming Model O320 engines (150 hp.) and Hartzell constant-speed, full-feathering propellers that was set for delivery to Piper's export representatives in Paris. Max Conrad flew it nonstop from New York over a week-end.

According to William Strohmeier, spokesman for Piper, Conrad's gross load at takeoff from Idlewild was 5,000 lb., a 1,500-lb. overload. Takeoff distance was 2,500 ft., with a 6 to 8 mph. crosswind. He left Idlewild at 11:27 A.M. Saturday, Nov. 6; passed over Gander at 6:35 P.M.; crossed Shannon at 5:58 A.M., Nov. 7, and landed at Paris' Toussous le Noble Airport at 9:50 A.M. Eastern Standard Time.

This meant that the Apache covered the 3,625-mi. official New York-Paris distance in 22 hr., 23 min. Unofficial report said he had 70 gal. of fuel remaining, which means an average fuel consumption of 12.88 gal. an hour. His average speed was 161 mph.

What about instruments? They were the standard installation on all Apaches. Nothing was added.

Radio? Strohmeier says this was standard as delivered in the Custom Apache for domestic use, including Narco Omnigator with ILS localizer and 8-channel transmitter, Narco Simplexer 12-channel VHF transmitter-receiver; Lear ADF-12 automatic DF. A Sunny South MF transmitter was added.

The two 36-gal. wing tanks were supplemented by three cabin tanks holding 288 gal., or 360 gal. of fuel all-told. Conrad also installed a system for adding engine oil. Range with this set-up was estimated at 25 to 26 hr.

"Conrad wore a USAF exposure suit and a Mae West life jacket," Strohmeier writes. "Food consisted of box of graham crackers, two Cokes and a grapefruit. Suitcase of normal clothing."

The plane, owned by Jonas Aircraft & Arms Co., Inc., of New York, Piper export representatives, will be used in Europe and North Africa for demonstration purposes. Piper says analysis shows flyaway delivery is "less expensive and more practical" than shipping to any part of the world.

That's the story, simply told. The facts need no elaboration. We congratulate everybody concerned. What a testimonial for Apaches!

No Deaths—No Headlines

It didn't appear in many newspapers, but Hawaiian Airlines came up with a mighty important story the other day. It celebrated its 25th anniversary on Nov. 11, which makes it one of America's oldest commercial air carriers.

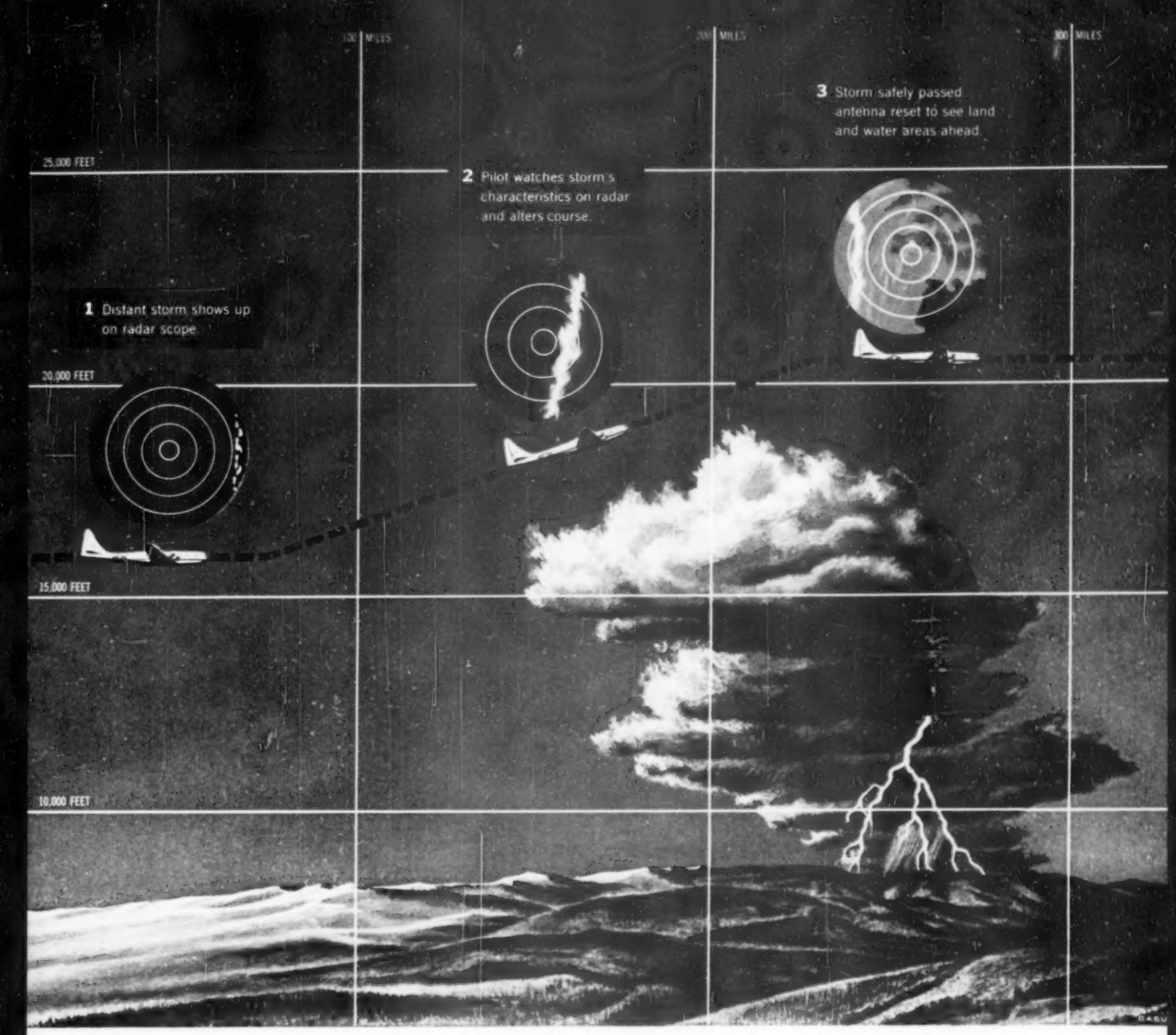
But the headline-making aspect—at least for an aviation magazine—is the added fact that in its entire history Hawaiian has never had a passenger or crew fatality or injury.

We are informed that in those 25 years, the line, founded by Stanley C. Kennedy, who is still its president, has carried 3,675,000 passengers, something like 500 million passenger-miles. It has won the National Safety Council's Aviation Safety Award every year of its life.

The council's Ned Dearborn calls Hawaiian's "the longest record of safe operation in aviation history."

Hawaiian's achievement is big news. Too bad there weren't big, black headlines splattered all over the nation's dailies.

—Robert H. Wood


100 MILES
200 MILES
300 MILES
25,000 FEET
20,000 FEET
15,000 FEET
10,000 FEET
1 Distant storm shows up on radar scope.
2 Pilot watches storm's characteristics on radar and alters course.
3 Storm safely passed antenna reset to see land and water areas ahead.

NEW RADAR GIVES USAF POWERFUL EYES

Sees Storms, Obstacles up to 240 Miles Away

THE STORY BEHIND THE STORY:

Unveiled at the National Aircraft Show in September, the new Sperry APN-59 Radar developed for the Air Force made headlines like the one above from coast to coast—and for good reason.

Airmen have needed, and wanted, truly versatile radar. To make navigation more accurate . . . to aid in flying over obscure, uncharted terrain . . . to elude storms . . . to avoid collisions . . . to direct rescues regardless of visibility. But—there has been a problem: Existing radars, to perform all of these functions, have required too much space and added too much weight.

Working with the Air Research and Development Command, Sperry engineers solved the problem by producing a new airborne radar that requires less space than a passenger, weighs less than 150 pounds. And versatile? Despite its small size and weight, this new APN-59 Radar now gives airmen a selection of ranges from 3 to 240 miles—a choice of "looking" straight ahead, below or above—and permits concentrating on any particular area of importance.

Developing the APN-59 Radar brought into play many of Sperry's specialized skills. Electronics—a field in which Sperry's development of the Klystron provided the heart of today's microwave radar. Gyroscopics—to assure "picture" stability in rough, turbulent air. And, of course, sound instrumentation based on Sperry's 40 years of experience in establishing standards for the aviation industry.

SPERRY GYROSCOPE COMPANY

DIVISION OF THE SPERRY CORPORATION · GREAT NECK, N. Y.

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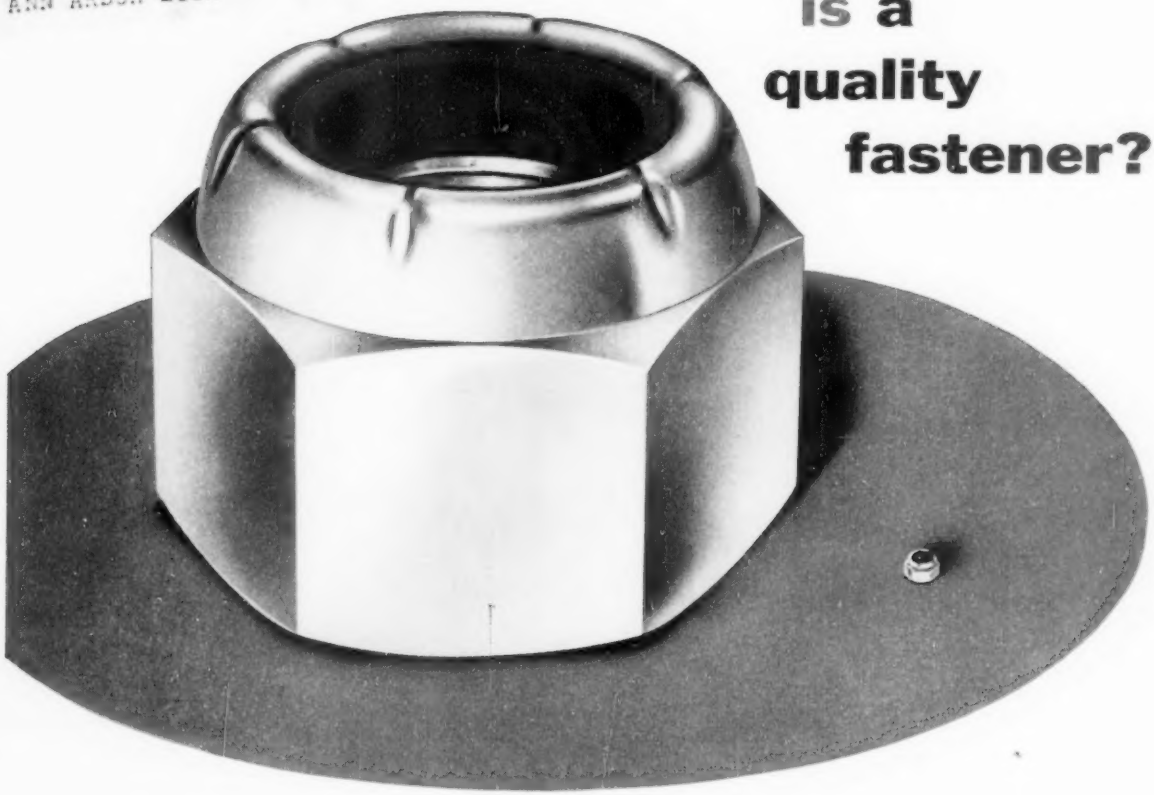
What size is a quality fastener?



Here are two ELASTIC STOP® nuts.
Each has the familiar red locking collar. Each is self-locking, vibration-proof and can be reused many times. Each is a fast, readily assembled one-piece unit . . . will maintain accurate adjustment anywhere on a bolt. Each will afford positive protection against thread corrosion . . . prevent liquid seepage along bolts. Each is manufactured in quantity. Each is exactly controlled as to quality of raw material, finished dimensions, class of thread fit, seat squareness and finish. Each has a record for precision and uniformly high performance that is unmatched.

But . . . one measures 1/10 inch across the flats; the other, 4 inches. Between these two, there are more than 530 different hex nuts in the ESNA line. They are the result of variations in height, material, finish and size.

Look to ESNA for the top quality self-locking fastener that fits your need best.

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ESNA® TRADE MARK

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Please send the following free fastening information:

☐ ELASTIC STOP nut bulletin

☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name_____ Title_____

Firm_____

Street_____

City_____ Zone_____ State_____